NUCLEAR R&D AND THE IDAHO NATIONAL LABORATORY

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY

COMMITTEE ON SCIENCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED EIGHTH CONGRESS

SECOND SESSION

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June 24, 2004

NUCLEAR R&D AND THE IDAHO NATIONAL LABORATORY

THURSDAY, JUNE 24, 2004

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY,
COMMITTEE ON SCIENCE,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:06 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Judy Biggert [Chairman of the Subcommittee] presiding.

COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

Nuclear R&D and the Idaho National Laboratory

Thursday, June 24, 2004
10:00am
2318 Rayburn House Office Building

Witness List

Mr. William Magwood
Director of the Office of Nuclear Energy, Science and Technology
The Department of Energy

Dr. Alan E. Waltar
Director of Nuclear Energy
Pacific Northwest National Laboratory

Dr. Robert L. Long
Nuclear Stewardship, LLC

Dr. Andrew C. Klein
Department Head and Professor, Nuclear Engineering and Radiation Health Physics
Director, Radiation Center
Oregon State University

HEARING CHARTER

SUBCOMMITTEE ON ENERGY
COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

Nuclear R&D and the Idaho National Laboratory

THURSDAY, JUNE 24, 2004
10:00 A.M.–12:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

1. Purpose

On Thursday, June 24, 2004, the Energy Subcommittee of the U.S. House of Representatives Committee on Science will hold a hearing to examine the Department of Energy's (DOE) plans to establish the Idaho National Laboratory (INL) in 2005 as the lead federal laboratory for nuclear energy research and development (R&D).

2. Witnesses

Mr. William D. Magwood, IV, is the Director of the Office of Nuclear Energy, Science and Technology (NE) at DOE.

Dr. Alan Waltar is the Director of Nuclear Energy at the Pacific Northwest National Laboratory (PNNL) and is a past President and Fellow of the American Nuclear Society. He participated in the development of the report *Nuclear Energy: Power for the 21st Century,* which was put together by seven national laboratories.

Dr. Robert Long is the President of Nuclear Stewardship LLC, a private consulting firm. Dr. Long chaired the Infrastructure Task Force of the DOE Nuclear Energy Research Advisory Committee (NERAC), which evaluated the status of the Idaho laboratory complex and recommended improvements.

Dr. Andrew Klein is the Chair of the Nuclear Engineering Department at Oregon State University. Dr. Klein currently chairs the NERAC Nuclear Laboratory Requirements Subcommittee charged with determining the characteristics, capabilities, and attributes of a world-class laboratory and making recommendations for building INL into a world leader in nuclear energy technology.

3. Overarching Questions

1. What are the vision and mission of the newly created Idaho National Laboratory (INL)? Is DOE taking the steps necessary to ensure INL's success?
2. How will the reorganization of the Idaho laboratory complex affect DOE's nuclear energy R&D program? What role will other national laboratories with significant nuclear expertise, such as Argonne National Laboratory, play in nuclear energy R&D after INL begins operations?
3. Is DOE's nuclear energy program on track to develop the next-generation technologies needed to meet the Administration's goal of an "expansion of nuclear energy in the United States as a major component of our national energy policy"?

4. Overview

DOE is undertaking a major reorganization of the national laboratory complex in Idaho with the goal of enhancing the focus on nuclear energy R&D.

On April 30, 2003 Secretary Abraham announced that DOE would divide the current activities of the Idaho National Engineering and Environmental Laboratory (INEEL) into two contracts. One contract would cover cleanup of the site, which the Federal Government has used for nuclear activities for 55 years. This first contract is designated the Idaho Cleanup Project (ICP). The other contract would be for the management of a new Idaho National Laboratory that would combine the current research activities of INEEL and Argonne National Laboratory-West (ANL–W), which shares the Idaho site. Under the plan, INL is to be the lead laboratory for

DOE's nuclear energy R&D activities.[1] DOE's objective is to establish INL as the leading center in the world for nuclear energy technology within 10 years.[2]

DOE issued the final Request for Proposals for the management and operations contract for the new Idaho National Laboratory (INL) on May 26, 2004. The tentative award date for the INL contract is November 15, 2004, and INL is scheduled to begin operations on February 1, 2005.

This reorganization will end the 50-year association of ANL–W and the main Argonne laboratory, Argonne National Laboratory-East (ANL–E), located south of Chicago, IL. It is unclear how the laboratory reorganization, and the designation of INL as the lead laboratory for nuclear energy research, will affect ANL–E and other national laboratories that conduct research related to nuclear energy.

The Current Idaho Laboratory Complex. The Idaho laboratory complex—the term that refers to INEEL and ANL–W—site is 890 square miles (roughly 85 percent the size of Rhode Island), most of which is open land.

INEEL includes a cleanup operation involving radioactive materials left over from the Cold War, as well as an applied engineering laboratory. Currently, environmental management (cleanup) activities account for slightly over 70 percent of INEEL program funding. The remaining 30 percent of INEEL funding is divided among programs in nuclear energy, energy efficiency and renewable energy, fossil energy, nuclear nonproliferation and national security. INEEL is operated for DOE by Bechtel BWXT Idaho, LLC, and employs about 6,000 people in its cleanup and R&D operations.

The Federal Government originally established the INEEL site as the National Reactor Testing Station in 1949. For many years, the Idaho site housed the largest concentration of nuclear reactors in the world—52 nuclear reactors have been built at the site, including the U.S. Navy's first prototype nuclear propulsion system.

ANL–W, also established in 1949, is a research laboratory focused on nuclear safety, treatment of spent nuclear fuel, nonproliferation, decommissioning and decontamination technologies, and similar work. The University of Chicago has operated both the main laboratory in Illinois and the Idaho site from their beginnings. Typically, basic research is conducted at the Illinois site, while large-scale nuclear facility testing and development is conducted at the Idaho site. ANL–W employs about 650 people.

5. Issues

Is DOE allocating sufficient funding to build INL into the world's lead laboratory for nuclear energy R&D?

The Nuclear Energy Research Advisory Committee (NERAC)—non-government experts appointed by DOE to give advice on nuclear energy R&D—appointed a Task Force, which released a report this April. The NERAC Task Force concluded, "The funding at the Idaho Site, given the lead lab status, is clearly insufficient." The Task Force also found that for the Administration to achieve its goals for nuclear energy, "the lead lab site at Idaho requires an immediate and significant increase in funding to, e.g., clear up maintenance backlog and make key facilities mission ready." By contrast, the Administration's fiscal year 2005 (FY05) request for nuclear energy R&D at INL is $6 million below the FY04 level for INEEL and ANL–W.[3]

DOE has said that more funds will become available for INL as the Idaho cleanup work is completed over the next decade. But the NERAC Infrastructure Task Force urged DOE not to link INL funding to future funding decreases for cleanup for two reasons. First, the cleanup effort could go over-schedule or over-budget as it has "many obstacles." Second, INL's needs are too immediate to permit a budget strategy that ramps up over time.

In addition, the budget for INL must be sufficient to fund the development of the Next Generation Nuclear Plant (NGNP)—discussed more below—which DOE's strategic plan describes as being central to the lab's new mission. The NGNP is a large, multi-year construction project that will cost in excess of $1 billion dollars.

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[1] Secretary of Energy Spencer Abraham announced a major mission realignment for the Idaho National Engineering and Environmental Laboratory on July 17, 2002, establishing the site as the Nation's leading center of nuclear energy research and development. (DOE Press Release No. R–02–144)

[2] A February 5, 2004 press release announcing DOE's draft Request for Proposals for the Idaho National Laboratory management contract states, "DOE expects that the laboratory will be the world's leading nuclear energy technology center within 10 years." (DOE Press Release No. R–04–023)

[3] According to the FY05 Energy and Water Appropriations Subcommittee report 108–554. The total funding for INEEL is about $840 million. Total funding for ANL–W is included in the overall ANL budget and is not available separately.

NERAC is continuing to review DOE's plans for INL. Earlier this year, NERAC created a Subcommittee on Nuclear Laboratory Requirements to build on the work of the Infrastructure Task Force. The subcommittee is charged with identifying the characteristics, capabilities, and attributes a world-class nuclear laboratory should possess.

What role will Argonne National Laboratory and other national laboratories with nuclear expertise play in nuclear energy R&D after INL begins operations?

The NERAC Infrastructure Task Force recommended that DOE's nuclear energy R&D program continues to use facilities beyond the Idaho site, including other national laboratories.

About 70 percent of DOE's nuclear energy R&D funds are currently spent outside of the Idaho site. Other national laboratories with relevant programs include Argonne, Oak Ridge National Laboratory, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Pacific Northwest National Laboratory, and Sandia National Laboratories.

How should INL balance its role as the lead laboratory for nuclear energy R&D and as a multi-purpose laboratory?

Members of NERAC have observed that maintaining a world-class laboratory requires supporting a sufficiently broad research program, including fields outside of traditional nuclear engineering such as materials science and computational science. Advantages of maintaining a diversity of research include opening up opportunities for cross-disciplinary research, and creating a greater draw for visiting researchers and new employees.

It remains unclear what balance the new INL will strike between nuclear and non-nuclear R&D. ANL–W has been dedicated exclusively to nuclear-related R&D throughout its history. DOE has repeatedly stated that, like the current INEEL, INL will be a multi-purpose laboratory. Yet the current strategic plan for the Idaho site emphasizes the laboratory's focus on nuclear-related research.[4] Clarifying the range of research activities appropriate for the new lab will be important to INL's long-term success.

What are the objectives for the Next Generation Nuclear Power Plant (NGNP)?

Identifying clear objectives for NGNP will be important to the project's success. The NGNP has been described in two potentially conflicting ways—on the one hand, as a demonstration of commercial viability, and on the other, as a research testbed. A demonstration project presumes more mature technology that is unlikely to be further upgraded through government work. A testbed would presumably be more research oriented with more expensive, leading-edge technologies.

One of the stated purposes for the NGNP is to produce hydrogen—an important part of the Administration's hydrogen initiative. But the commercial interest in producing hydrogen through nuclear sources is uncertain at best, and the requirement to produce hydrogen significantly increases the costs of the reactor and changes its design.

6. Background on Nuclear R&D

Nuclear Industry Overview. With an installed capacity of 98.1 gigawatts, nuclear power provides 20 percent of the electricity generated in the United States. Thirty-one states, including the majority of the Eastern half of the country, are home to nuclear power plants, with five states—New Jersey, Vermont, New Hampshire, South Carolina, and New York—producing more of their electricity from nuclear power than any other source, according to the Nuclear Energy Institute. Illinois produces one half of its electricity through nuclear power.

The Energy Information Administration (EIA) forecasts that nuclear generating capacity will increase slightly by 2025, to 99.6 gigawatts installed capacity, due to nuclear plant life extensions and increased utilization of existing plants. However, with the May 2001 announcement that Federal Government will "support the expansion of nuclear energy in the United States as a major component of our national energy policy," supporters of nuclear energy project far larger increases for nuclear power. Under EIA projections, nuclear generation capacity would need to increase by over 60 gigawatts by 2020 to continue to provide 20 percent of the Nation's electricity. However, a significant expansion of nuclear power will require im-

[4] *Idaho National Engineering and Environmental Laboratory (INEEL) Strategic Plan, January 2003.*

provements in cost, safety, waste management, and proliferation risk.[5] No new nuclear power plants have been ordered since 1977.

DOE Nuclear Energy R&D Programs. The Administration's FY05 budget request for the Office of Nuclear Energy, Science, and Technology was $409.6—about $5 million more than the FY04 comparable appropriation. Of those amounts, the budget proposes to spend about $97 million on R&D—a cut of about $34 million from current spending.

DOE supports four major programs in nuclear energy R&D: the Nuclear Hydrogen Initiative, Advanced Fuel Cycle Initiative, Nuclear Power 2010, and Generation IV. Each program is described below, along with its current year funding and the funding included in Energy and Water Appropriations Subcommittee mark for FY05.

Nuclear energy R&D conducted at the national laboratories is allocated from the program lines described below.

Nuclear Hydrogen Initiative (FY04 $6.5 million, E&W Mark $9.0 million)

The Nuclear Hydrogen Initiative is a program to conduct R&D on how to produce hydrogen using nuclear energy.

Advanced Fuel Cycle Initiative (AFCI) (FY04 $67 million, E&W Mark $68 million)

The mission of the AFCI is to develop new ways to treat spent nuclear fuel. One goal of the program is to inform a recommendation by the Secretary of Energy by 2010 on whether the U.S. needs a second nuclear waste repository in addition to Yucca Mountain.

Nuclear Power 2010 (FY04 $19 million, E&W Mark $5 million)

The Nuclear Power 2010 program is a joint government/industry cost-shared effort to identify sites for new nuclear power plants, develop advanced nuclear plant technologies, evaluate the business case for building new nuclear power plants, and demonstrate untested regulatory processes. These efforts are designed to pave the way for an industry decision by the end of 2005 to order a new nuclear power plant which would begin commercial operation early in the next decade.

Generation IV (FY04 $28 million, E&W Mark $40 million)

The goal of the Generation IV Nuclear Energy Systems Initiative is to address the fundamental research and development issues necessary to establish the viability of a next-generation nuclear energy system. The program is designed to improve safety, sustainability, cost-effectiveness, and proliferation resistance.

7. Questions to the Witnesses

Questions for Mr. William Magwood, IV

Your testimony should address the Department of Energy's (DOE) plans to reorganize the Idaho laboratory complex to form a new national laboratory. Please describe the reasons for designating this newly created laboratory as the lead laboratory for nuclear energy research and development (R&D). Specifically, please focus your testimony on the following questions:

1. What is the Department's view of the Report of the Infrastructure Task Force of the Nuclear Energy Research Advisory Committee, particularly its conclusion that, given the lead laboratory status, funding at the Idaho Site is clearly insufficient?
2. What role will Argonne National Laboratory and other national laboratories with nuclear expertise play in nuclear energy R&D after the Idaho National Laboratory (INL) is established?
3. The Department has indicated that INL will be a multi-purpose laboratory, but the current strategic plan for the Idaho National Engineering and Environmental Laboratory emphasizes the laboratory's transition to a focus on nuclear-related research. What specific programs do you envision supporting at INL beyond nuclear- and environmental management-related research?
4. The Next Generation Nuclear Plant (NGNP) has been described both as a demonstration of commercial viability and as a research testbed. What is the Department's view of the purpose of the NGNP? To what extent is the design of the NGNP being influenced by the requirements imposed by hydrogen production? To what extent would INL be capable of world leadership in nuclear energy R&D if the NGNP does not go forward?

[5] See for example, "The Future of Nuclear Power, An Interdisciplinary MIT Study," cited above.

Questions for Dr. Alan Waltar

In your testimony, please briefly outline the conclusions of the Seven Lab Action Plan, *Nuclear Energy: Power for the 21st Century.* Please also answer the following questions:

1. What should the U.S. goals be in the field of nuclear power? How can the new Idaho National Laboratory best contribute to those goals?
2. Are there gaps in the Department's present nuclear energy research and development (R&D) portfolio? Are there current research programs you would recommend discontinuing? If so, please explain your recommended changes.
3. The Department is working in partnership with the nuclear power industry to enable a new nuclear plant to be ordered and licensed for deployment within the decade. Is the nuclear energy R&D portfolio adequate to meet this goal? If not, how could this be rectified?
4. The Next Generation Nuclear Plant (NGNP) has been described both as a demonstration of commercial viability and as a research testbed. What do you believe the purpose of the NGNP should be? To what extent is the design of the NGNP being influenced by the requirements imposed by hydrogen production? To what extent would INL be capable of world leadership in nuclear energy R&D if the NGNP does not go forward?

Questions for Dr. Robert Long

In your written testimony, please briefly describe the recommendations made by the Nuclear Energy Research Advisory Committee Infrastructure Task Force. Please also answer the following questions:

1. What role do you recommend that Argonne National Laboratory and other national laboratories with nuclear expertise play in nuclear energy R&D after the Idaho National Laboratory (INL) is established?
2. The Department has indicated that INL will be a multi-purpose laboratory, but the current strategic plan for the Idaho National Engineering and Environmental Laboratory emphasizes the laboratory's transition to a focus on nuclear related research. What specific programs should the Department support at INL beyond nuclear and environmental management related research?
3. The Next Generation Nuclear Plant (NGNP) has been described both as a demonstration of commercial viability and as a research testbed. What do you believe the purpose of the NGNP should be? To what extent is the design of the NGNP being influenced by the requirements imposed by hydrogen production? To what extent would INL be capable of world leadership in nuclear energy R&D if the NGNP does not go forward?

Questions for Dr. Andrew Klein

In your written testimony, please describe the work of the Nuclear Energy Research Advisory Committee subcommittee that you chair, and any preliminary recommendations you can make based on the work of the subcommittee thus far. Please also answer the following questions:

1. What role do you recommend that Argonne National Laboratory and other national laboratories with nuclear expertise play in nuclear energy R&D after the Idaho National Laboratory (INL) is established?
2. The Department has indicated that INL will be a multi-purpose laboratory, but the current strategic plan for the Idaho National Engineering and Environmental Laboratory emphasizes the laboratory's transition to a focus on nuclear-related research. What specific programs should the Department support at INL beyond nuclear- and environmental-management related research?
3. The Next Generation Nuclear Plant (NGNP) has been described both as a demonstration of commercial viability and as a research testbed. What do you believe the purpose of the NGNP should be? To what extent is the design of the NGNP being influenced by the requirements imposed by hydrogen production? To what extent would INL be capable of world leadership in nuclear energy R&D if the NGNP does not go forward?

Chairman BIGGERT. This hearing will come to order. Good morning and welcome, everyone.

Today's hearing is on the future of nuclear energy R&D and the creation of Idaho National Laboratory. On August—or April 30, 2003, Secretary Abraham announced that the Department of Energy would combine the research activities of the Idaho National Engineering and Environmental Lab and Argonne National Laboratory West to create a new lab, the Idaho National Laboratory, or INL. Under the Department's plan, INL will be the lead laboratory for DOE's nuclear energy R&D activities. The Department hopes to establish INL as the leading center in the world for national energy technology within 10 years.

I support the Department's designation of a leading laboratory, but I do have serious concerns about how the Department is going about creating this laboratory. Specifically, I am concerned about the impact this decision may have on existing nuclear R&D programs and facilities, including those in Idaho, that have served the Nation well for decades. I am also concerned that the Department's decision may sever one of the last best teams of nuclear scientists at Argonne National Laboratory-East and West. In doing so, the Department could end up fracturing the laboratory that has been the driving force behind the development of advanced nuclear technology for almost 50 years. Time will tell, and much will depend on who bids for and is awarded the contract to manage this new lab.

As a lifelong resident of the State of Illinois, which gets 50 percent of its electricity from nuclear energy, I am a strong supporter of nuclear energy, and that is why I am here today to ask some tough questions about this new lab. I want to make sure it enhances rather than detracts from what I believe has been a 50-year success story, namely our nuclear energy R&D program.

There is no denying that the new INL is coming into the world with a lot of weight on its shoulders: the Department's budget request with decreased funding for nuclear energy R&D overall in fiscal year 2005. In fact, nuclear energy R&D at the Idaho site itself would decrease by $6 million under the Department's proposed budget. The DOE asserts that more funds will become available for INL as the Idaho cleanup work is completed over the next decade. But the Nuclear Energy Research Advisory Committee, called NERAC for short, urged DOE not to link INL funding to completion of the cleanup effort for two reasons. First, many obstacles to the cleanup remain and could cause it to go over schedule or over budget. And second, INL's needs are too immediate to permit a budget strategy that ramps up over time. The Idaho lab complex is burdened with a backlog of needed maintenance work and facility upgrades. NERAC estimates that getting the INL mission ready will require immediate investments totally over $90 billion—I am sorry, that is $90 million. I saw a few eyebrows raise right there. And will require additional funding of several million dollars each year thereafter.

The future of INL is, in part, linked to the Next Generation Nuclear Power Plant, and we are asking a lot of this $1 billion project that is described as research test bed as a demonstration of an advanced nuclear design and as a demonstration of commercial-scale hydrogen production. We may be able to balance all of these elements, but only through careful thought and planning.

The good news is that INL doesn't have to go at it alone. The new INL will be the Department of Energy's lead lab for nuclear energy R&D, but let us not forget that it will also be a member of a team. We have a great deal of nuclear energy expertise in residence at other national labs, including Argonne, Oak Ridge, and Los Alamos. For the overall nuclear energy R&D program to continue to be a success, its lead laboratory must succeed, but not at the expense of the program's other laboratories.

As we proceed today, we must keep these questions in mind: "Are we doing everything we can to ensure the success of our nuclear energy R&D program? And are we putting the resources of all of our national laboratories to the best possible use?"

I believe nuclear energy is at a crossroads; the choices we make today about our nuclear energy R&D investments may determine whether or not nuclear power is a viable option for the rest of the 21st century. It is important that we get this right.

[The prepared statement of Chairman Biggert follows:]

PREPARED STATEMENT OF CHAIRMAN JUDY BIGGERT

The hearing will come to order.

Good morning, and welcome, everyone.

Today's hearing is on the future of nuclear energy R&D and the creation of the Idaho National Laboratory. On April 30, 2003, Secretary Abraham announced that the Department of Energy (DOE) would combine the research activities of the Idaho National Engineering and Environmental Laboratory and Argonne National Laboratory-West to create a new lab, the Idaho National Laboratory, or INL.

Under the Department's plan, INL will be the lead laboratory for DOE's nuclear energy R&D activities. The Department hopes to establish INL as the leading center in the world for nuclear energy technology within 10 years.

I support the Department's designation of a lead laboratory, but I have serious concerns about how the Department is going about creating this laboratory. Specifically, I am concerned about the impact this decision may have on existing nuclear R&D programs and facilities, including those in Idaho, that have served the Nation well for decades.

I also am concerned that the Department's decision may sever one of the last, best teams of nuclear scientists at Argonne National Laboratory, East and West. In doing so, the Department could well fracture a laboratory that has been the driving force behind the development of advanced nuclear technologies for almost 50 years. Time will tell, and much will depend on who bids for and is awarded the contract to manage this new lab.

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There is no denying that the new INL is coming into the world with a lot of weight on its shoulders. The Department's budget request would *decrease* funding for nuclear energy R&D overall in FY05. In fact, nuclear energy R&D at the Idaho site itself would decrease by $6 million under the Department's proposed budget.

The DOE asserts that more funds will become available for INL as the Idaho cleanup work is completed over the next decade. But the Nuclear Energy Research Advisory Committee, called NERAC for short, urged DOE *not* to link INL funding to completion of the cleanup effort for two reasons. First, there are many remaining obstacles to the cleanup effort that could cause it to go over-schedule or over-budget.

Second, INL's needs are too immediate to permit a budget strategy that ramps up over time. The Idaho lab complex is burdened with a backlog of needed maintenance work and facility upgrades. NERAC estimates that getting INL mission-ready will require immediate investments totaling over $90 million, and will require additional funding of several million dollars each year thereafter.

The future of INL is, in part, linked to the Next Generation Nuclear Power Plant, or NGNP. We're asking a lot of this $1 billion project. It's described as a research test-bed, as a demonstration of an advanced reactor design, and as a demonstration of commercial-scale hydrogen production. We may be able to balance all of these elements, but only through careful thought and planning.

The good news is that INL doesn't have to go it alone. The new INL will be the Department of Energy's lead lab for nuclear energy R&D, but let's not forget that it will also be a member of a team. We have a great deal of nuclear energy expertise in residence at other national labs, including Argonne, Oak Ridge, and Los Alamos. For the overall nuclear energy R&D program to continue to be a success, its lead laboratory must succeed, but not at the expense of the program's other laboratories.

As we proceed today, we must keep these questions in mind: *Are we doing everything we can to ensure the success of our nuclear energy R&D program? And are we putting the resources at all our national laboratories to the best possible use?*

I believe nuclear energy is at a crossroads. The choices we make today about our nuclear energy R&D investments may determine whether or not nuclear power is a viable option for the rest of the 21st century. It's important that we get this right.

Chairman BIGGERT. I will now turn to the Ranking Member of the Energy Subcommittee for his opening statement.

Mr. LARSON. Thank you, Madame Chair. And let me associate myself with your remarks and acknowledge that today we are addressing an issue of importance to a wide range of interests. The Department of Energy has a vision for nuclear energy research and the future of the Idaho site.

If all goes as planned by the Administration, we may see significant changes, not only in Idaho, but throughout the national laboratory complex. Understandably, labs such as Los Alamos, Oak Ridge, and Argonne are very concerned about the impacts in making the Idaho laboratory the flagship facility for nuclear energy research. Idaho has a long history of valuable nuclear research, but it is not the only site for this work, and we should be careful in consolidating all of our research into one place. One observer noted that this is "analogous to closing down all university nuclear engineering departments and consolidating them into a single university". It simply is not practical nor is it wise. Sources tell us that there are a number of vital programs at other labs that the Idaho lab is not equipped to handle. Upgrading facilities at Idaho to accomplish—to accommodate this work would have costs well above the projected budget. In these cases, it only makes sense to leave such programs where they are.

We will be paying close attention to the Department as it executes its plans for the Next Generation Power Reactor. If production of hydrogen is such an important part of this project and the President is serious about his vision for a hydrogen economy, it would only make sense that we include domestic hydrogen industries in the demonstration of these technologies. This can be said for other components of the project as well. Large projects such as this are too costly to have the benefits fall into the hands of foreign companies.

While I have reservations, I am not opposed to the creation of the Idaho National Laboratory, and I commend the Department's efforts in making it a world-class facility. On the surface, there is some wisdom in the idea of moving nuclear energy research to a remote region of Idaho, but given the limited budget for nuclear research at DOE, we are concerned the Department will dip into resources of other labs to fund work at Idaho instead of leveraging their key capabilities and expertise. Labs should partner with other laboratories and universities to make their vision for Idaho work. Research in advanced nuclear power systems is beyond the scope of any one laboratory. Idaho has a long history of research in nuclear energy, but it is not the only site to conduct this research, and nor should it be.

Thank you, Madame Chair, and I yield back the remainder of my time.

[The prepared statement of Mr. Larson follows:]

PREPARED STATEMENT OF REPRESENTATIVE JOHN B. LARSON

Thank you Madame Chair.

Today we are addressing an issue of importance to a wide range of interests. The Department of Energy has a vision for nuclear energy research and the future of the Idaho site. If all goes as planned by the Administration, we may see significant changes not only in Idaho, but throughout the national laboratory complex.

Understandably, labs such as Los Alamos, Oak Ridge and Argonne are very concerned about the impacts of making the Idaho National Laboratory the flagship facility for nuclear energy research.

Idaho has a long history of valuable nuclear research. But it is not the only site for this work and we should be careful in consolidating all of our research into one place. One observer said that this is analogous to closing down all university nuclear engineering departments and consolidating them at a single university. It simply is not practical or wise.

Sources tell us that there are a number of vital programs at other labs that the Idaho lab is not equipped to handle. Upgrading facilities at Idaho to accommodate this work would have costs well above the projected budget. In these cases, it only makes sense to leave such programs where they are.

We will be paying close attention to the Department as it executes its plans for the next generation power reactor. If production of hydrogen is such an important part of this project, and the President is serious about his vision for a hydrogen economy, it would only make sense that we include domestic hydrogen industries in the demonstration of these technologies.

This can be said for other components of the project, as well. Large projects such as this are too costly to have the benefits fall into the hands of foreign companies.

For the most part, I am not opposed to the creation of the Idaho National Laboratory and I commend the Department's efforts in making it a world class facility. On the surface, there is some wisdom in the idea of moving nuclear energy research to a remote region of Idaho.

But, given the limited budget for nuclear research at DOE, we are concerned that the Department will dip into resources of other labs to fund work at Idaho, instead of leveraging their key capabilities and expertise. The lab should partner with other laboratories and universities to make their vision for Idaho work.

Research in advanced nuclear power systems is beyond the scope of any one laboratory. Idaho has a long history of research in nuclear energy. But it is not the only site to conduct this research, and nor should it be.

Thank you, Madame Chair. I yield back the remainder of my time.

Chairman BIGGERT. Thank you, Mr. Larson. I would like, at this time, to ask unanimous consent that all Members who wish to do so have their opening statements entered into the record and that all written testimony submitted by the witnesses be placed in the record. Without objection, so ordered.

It is my pleasure to welcome our witnesses for today's hearing and to introduce them to you. They are Mr. William D. Magwood, IV, Director of the Office of Nuclear Energy Science and Technology at the Department of Energy, and Dr. Alan Waltar, Director of Nuclear Energy at the Pacific Northwest National Laboratory and past president of the American Nuclear Society. Welcome. Dr. Robert Long, President of Nuclear Stewardship, LLC, a private consulting firm. Dr. Long chaired the Infrastructure Task Force of the DOE Nuclear Energy Research Advisory Committee, or NERAC, which evaluated the status of the Idaho laboratory complex and recommended improvements. And last but not least, Dr. Andrew Klein, head of the Nuclear Engineering Department at Oregon State University. Dr. Klein currently chairs the NERAC subcommittee charged with determining the characteristics, capabilities, and attributes of a world-class laboratory and making recommendations for building INL into a world leader in nuclear energy technology. I thank each of you for joining us today. And as the witnesses know, spoken testimony will be limited to five minutes each, after which the Members will have five minutes each to ask questions.

And we will begin with Mr. Magwood.

STATEMENT OF MR. WILLIAM D. MAGWOOD, IV, DIRECTOR OF THE OFFICE OF NUCLEAR ENERGY, SCIENCE AND TECHNOLOGY, THE DEPARTMENT OF ENERGY

Mr. MAGWOOD. Thank you, Chairman.

Chairman, Mr. Larson, Members of the Subcommittee, I am Bill Magwood. I am Director of DOE's Office of Nuclear Energy Science and Technology, and it is a great pleasure to appear before this subcommittee again to discuss our plans for nuclear research and for the development of the Idaho National Laboratory.

As outlined in the National Energy Policy, which was issued shortly after President Bush took office, this Administration is vitally interested in the continuing role of nuclear energy in this country and in the expansion as an important component of our energy resources. Over the last three years, we have advanced the agenda for nuclear energy research and development in several significant ways that reflect the focus and commitment of our Department in this important energy resource. Our efforts have gained momentum, and continue to do so, with each passing week, and we are confident about the agenda that we have established.

We have not done this alone. All of our programs are characterized by a high degree of oversight and peer review from independent sources. The Nuclear Energy Research Advisory Committee, or NERAC, has eight active subcommittees that interact with my office to pursue our nuclear energy agenda and has made a very real and substantial difference in the development of our programs. I am pleased to appear today with two members of that body, Dr. Long and Dr. Klein, both of whom have led important subcommittees, some of which you will hear about today.

We have also worked hard to bring an international characteristic to all of our programs. We established a Generation IV International Forum, a collective of ten countries working together to advance nuclear technology with this in mind. That group, in coordination with NERAC, had led the evaluation over 100 different nuclear energy concepts from all over the world by over 100 scientists from all over the world to determine the most promising technologies for the future. After a complex, carefully managed two-year process, the Generation IV International Forum concluded that six concepts held the most promise for the future, and a number of countries have agreed on a framework to allow the countries to work together to develop these technologies.

For our part, we have already indicated in a report to Congress last year that the Department of Energy has selected one technology as its lead technology in Generation IV. This technology is now known as the Next Generation Nuclear Power Plant. The base concept of the Next Generation Nuclear Plant, or NGNP, is that of a very high temperature, gas cooled reactor system with an advanced high efficiency turbine generator and an even more advanced thermal chemical hydrogen production system. We have very high expectations for this technology.

Pursuant to this, the Department recently published a draft strategy for proceeding with the construction of the NGNP pilot plan. We are holding a public meeting tomorrow at the eight headquarters to respond to questions about this proposed strategy, and I invite you to have your staff attend that, and we look forward to answering any questions they may have as well. We have asked the U.S. private sector, which we have asked to take a lead on this project, to submit comments on the strategy by July 2. We will use this input to support the consideration of a mission need analysis for this project under the Department's highly disciplined project management process.

But let me be clear, DOE has not made a final decision in constructing an NGNP at this point. However, should the decision be made to proceed with the facility, it is our intent that the new Idaho National Laboratory would play a central role in the project by supporting all of the technical evaluation and research and development needs for the project. In doing so, the INL would attract many new talented scientists and engineers, establish strong ties with industry, academia, and the international community, and become involved in other ways, which will set it on a path to establish it as a pre-eminent nuclear energy research laboratory in the world in a 10-year period.

As Secretary Abraham has called the command center of a revived nuclear technology education and research enterprise in this country, the new lab will become a vital part to the Department in realizing our vision for nuclear energy. As such, it can not be the only location where vital nuclear energy research is performed. We expect that, as a command center for nuclear energy, the INL will form close and productive relationships with other national laboratories, particularly those where important, irreplaceable expertise and capabilities exist today. We fully expect the labs, such as Argonne, Oak Ridge, Los Alamos, and Sandia will remain important contributors to the Department's nuclear energy R&D efforts. We do not anticipate the consolidation of all programs into the Idaho laboratory. What we do anticipate is that Idaho will be at the leading edge of new programs that we develop.

For nuclear energy to have missions, we have asked NERAC to evaluate the assets in Idaho and recommend to us the improvements it believes we should make, not just in the facilities and equipment, but also in less tangible areas, such as personnel development and incentives to develop a laboratory culture. We look forward to receiving their recommendations later this year. In the interim, we continue to plan for the maintenance of the existing facilities at INL and consider new investments in infrastructure, and we have developed a 10-year site plan to focus our efforts to assure that we have a long-term planning basis.

In summary, we believe that by returning the Idaho lab to its roots, we are creating a much-needed focal point for the nuclear energy R&D program in this country. As demonstrated by the stockpile stewardship program, the renewable energy program, and others, a complex research program can benefit from the contributions of many organizations, but at its core, it needs a small number of institutions that are focused in making that program a success. For nuclear technology, we believe the Idaho lab is the right place to focus our efforts, and that renewed focus will give a boost to nuclear energy R&D across the country.

Thank you for holding this hearing, and thank you for the opportunity to appear today, and I look forward to answering any questions you have.

Thank you.

[The prepared statement of Mr. Magwood follows:]

PREPARED STATEMENT OF WILLIAM D. MAGWOOD, IV

Chairman Biggert and Members of the Subcommittee, I am William D. Magwood, IV, Director of the DOE Office of Nuclear Energy, Science and Technology. It is a pleasure to appear here today to discuss our views of the future of nuclear energy research and development and the important role the new Idaho National Laboratory will play in meeting our research objectives. As outlined in the *National Energy Policy* issued shortly after President Bush took office, this Administration is vitally interested in continuing the development of nuclear energy and expanding its use in the U.S.

Over the last three years, we have advanced the agenda for nuclear energy and nuclear research in several significant ways that reflect the focus and commitment the Department has placed on this important energy source. We have established strong cooperation with industry through our Nuclear Power 2010 program, working with utilities to examine the potential of ordering new nuclear power plants for operation in the United States within the next few years. We have developed new, important technology in the Advanced Fuel Cycle Initiative, pointing the way toward a better, more proliferation-resistant nuclear fuel cycle. We have established the Generation IV International Forum, working with the world's advanced nuclear technology nations to identify and develop the most promising next generation nuclear energy technologies for the future.

Our nuclear energy research programs are highly integrated and interdependent. Our Generation IV activities, for example, rely on success in the Advanced Fuel Cycle Initiative to create the advanced nuclear fuels for most of the six next-generation nuclear energy system concepts. Our Nuclear Hydrogen Initiative is dependent upon the success of the Generation IV effort to create the reactor technologies that can supply the very high temperature heat needed to make hydrogen production economic and practical on a commercial scale. This integration can be difficult from a management perspective, but highly beneficial from both a results and an efficiency standpoint. While each program has its own goals and objectives, our success will be greatly magnified when the products of each program are brought together at the end.

All of our programs are characterized by a high degree of independent oversight and peer review. The Nuclear Energy Research Advisory Committee (NERAC) has eight active subcommittees interacting with my Office to pursue our nuclear energy R&D goals. Under the leadership of the Chair, former Deputy Secretary of Energy Bill Martin, and the Vice Chair, former Nuclear Regulatory Commission Chairman John Ahearne, NERAC is one of the most active, engaged, and committed advisory bodies in existence and the time and effort the members of this group have devoted to their advisory role has made a very real and substantial difference in the development of our programs.

All of our programs benefit from a philosophy that to be successful, the next generation of nuclear technologies must not be used just in the United States, or just in Japan, or just in France—but used internationally in a standardized fashion. We often consider the aircraft industry to be a good model. Just as it would not be economically viable to build one or two airliners in each country using unique designs, it will not economically viable to do so with future nuclear power plants. Instead, like the case of airliners, we must benefit from coordinated worldwide efforts and acceptability of a few technologies in many countries. In this way, the market for future plants is large, as are the economies of manufacturing scale.

Because of this view, we have worked hard to bring an international character to all of our programs. We established the Generation IV International Forum, or GIF, with this in mind. That group, in coordination with NERAC, led the evaluation of over 100 different nuclear energy concepts by over 100 expert scientists and engineering from over a dozen countries. After a complex, carefully managed two year process, the GIF concluded that six technology concepts held the most promise for the future and the GIF member countries agreed to establish an international framework to allow all countries to work on the technologies of greatest interest to them in direct partnership with other member countries.

For our part, as we indicated in our report to Congress last year on the U.S. Generation IV program, the Department of Energy has selected one of the six technologies as its lead technology. This technology is now known as the Next Generation Nuclear Plant, or NGNP. The NGNP would be able to make both electricity and hydrogen at very high levels of efficiency; would be deployable in modules that will better fit the high competitive, deregulated market environment in the United States; and would be extraordinarily safe, proliferation-resistant, and waste-minimizing.

The base concept of the NGNP is that of a very-high temperature gas-cooled reactor system coupled with an advanced, high-efficiency turbine generator and even more advanced thermochemical hydrogen production system. We have very high expectations for this technology. As we indicated in our recent request for Expressions of Interest (EOI), we are interested in the eventual deployment of commercial plants that can generate electric power at a cost of less than 1.5 cents/kilowatt hour; produce hydrogen at a cost of less than $1.50/gallon-gasoline equivalent; and cost less than $1000/kilowatt to construct with a goal of $500/kilowatt.

If we are successful in creating such a technology, we will change the game with respect to the energy and environment future of the United States. We will not only assure a vibrant, long-term future for nuclear energy that will allow the Nation to benefit from nuclear energy's enviable environmental qualities, but we will expand its advantages from electricity production to fueling the Nation's vast transportation system. In doing so, we will enable the President's vision, as articulated in his Hydrogen Fuel Initiative, to be realized far earlier than many thought possible.

The Department is working with its international partners to define the research and development activities that could enable an NGNP to be demonstrated in pilot form before 2020. We have asked the U.S. private sector to submit comments on the NGNP strategy by July 2 of this year, as well as to indicate their potential interest in serving as the Project Integrator.

As noted in the Request for Expressions of Interest, DOE has not made a final decision to construct a NGNP facility. And, although it might be reasonable to infer that should such a decision be made, the NGNP would be located at INL, we have not made a final site selection, nor have we secured the required out-year funding. However, the Department intends that the INL would play a central role throughout the NGNP effort. Should the decision be made to build an NGNP pilot plant, it would be our preferred path to build the facility under a cooperative arrangement with the private sector. We believe that such a project should be, first and foremost, focused on the development of a technology that can be deployed by the private sector sometime after 2020. Such a technology must be flexible, safe, reliable, and consistent with the economic realities of the market (with or without the advent of a "hydrogen economy").

Our EOI noted that one management and funding option the Department is considering is to work with a Project Integrator to pursue this technology. This entity would work closely with the INL to develop and manage research and development plans. In doing so, the INL would attract many new talented scientists and engineers; establish strong ties with industry, academia, and the international community; and evolve in other ways which will set it on the path to establish the Nation's pre-eminent laboratory for nuclear energy research in 10 years.

This goal is the central objective we have set for the new M&O contractor for the Idaho National Laboratory. The new contractor will have the task of merging the lab operations of Argonne National Laboratory-West and Idaho National Engineering and Environment Laboratory to create a new, multi-program national laboratory that will serve as what Secretary Abraham called the "command center" of a revived nuclear technology, education, and research enterprise in this country.

In this role, the new lab will become a vital partner to the Department of Energy in realizing the vision for nuclear energy we have been developing over the last several years. As such, it cannot be the only location where vital nuclear energy research is performed. We expect that as the "command center" for the nuclear energy program, the INL will form close and productive relationships with other national laboratories—particularly those where important, irreplaceable expertise and capabilities exist today. In particular, Argonne National Laboratory (with its unique expertise in reactor analysis, reactor safety, physics and computer codes); Oak Ridge National Laboratory (which has great expertise in materials and chemical processes); Los Alamos National Laboratory (which has some the Department's finest advanced nuclear fuel technology capabilities); and Sandia National Laboratories (which has outstanding energy conversion, systems engineering, and nonproliferation expertise) will all be important contributors to all of the Department's major nuclear energy R&D efforts. To facilitate this, DOE has established a program management structure that includes National Technical Directors and System Integrators, many of whom are based at DOE laboratories outside of Idaho. This program management structure will help ensure that the best technical talent is brought to bear on DOE's nuclear energy R&D programs, no matter where that talent may reside.

The designation of the INL as the leader for nuclear R&D is consistent with the lab's historic role as the focal point for the development of commercial nuclear power in the world. The first usable quantities of electricity produced by nuclear power occurred at what was then known as the National Reactor Testing Station in Idaho. The first city lighted by nuclear power was Arco, Idaho, using power from a reactor at this facility. Fifty-two reactors have been built and operated in Idaho over the years, the largest concentration in the world.

Beyond nuclear energy research, we envision the INL becoming a multi-program laboratory, with a broad and varied portfolio of work. We believe that a diverse scope of work activities would provide a sound intellectual basis for the lab and help attract the wide range of expert researchers and technologists from many disciplines that will be needed to allow us to reach our ambitious nuclear energy goals. In addition to its nuclear energy role, the request for proposals indicates that the new INL M&O contractor will:

- Consolidate at the INL the ability to fabricate, test and assemble plutonium238 power systems needed for both national security and space exploration;
- Establish a Center for Advanced Energy Studies in Idaho Falls, Idaho, in which the INL, Idaho and other regional and national universities cooperate to conduct on-site research, classroom instruction, technical conferences and other events for a world-class academic and research institution;
- Be a lead science and technology provider in nuclear nonproliferation and counter proliferation, and become the Nation's leader in developing science-based, technical solutions protecting the country's critical infrastructure; and
- Research, develop and deploy technologies that improve the efficiency, cost effectiveness and environmental impacts of systems that generate, transmit, distribute and store electricity and fuels.

For the nuclear energy and other missions, we have asked the Nuclear Energy Research Advisory Committee to evaluate the assets in Idaho and to recommend to us improvements it believes we should make not just in facilities and equipment, but also in less tangible areas, such as personnel development and incentives and laboratory culture. We look forward to receiving their recommendations later this year. In the interim, we continue to plan for the maintenance of the existing facilities at INL and consider new investments in the infrastructure.

In summary, we believe that by returning the Idaho lab to its roots, we are creating a much-needed focal point for the nuclear energy R&D program in this country. As demonstrated by the stockpile stewardship program, the renewable energy program, and others, a large research program can benefit from the contributions of many organizations, but at its core needs a small number of institutions that are focused on making that program a success. We believe that the Idaho lab is the right place for this focus to occur, and that a renewed focus will give a boost to nuclear energy R&D across the U.S.

Thank you for the opportunity to appear before you today, and I look forward to answering any questions you may have.

BIOGRAPHY FOR WILLIAM D. MAGWOOD, IV

William D. Magwood, IV is the Director of the Office of Nuclear Energy, Science and Technology in the U.S. Department of Energy. He was appointed to this position on November 8, 1998.

As the Director of Nuclear Energy, Science and Technology, Mr. Magwood is the senior nuclear technology official in the United States Government and the senior manager for all of the Office's programs. Under Mr. Magwood's leadership, the Office of Nuclear Energy, Science and Technology has led the Nation in a new consideration of nuclear technology as a means to address difficult problems facing the Nation in the 21st Century.

Mr. Magwood is leading the Department's *Nuclear Power 2010* initiative, aimed at building new nuclear plants in the U.S. by 2010 as a key to long-term energy security. He is also leading the *Generation IV* initiative, working closely with the *Generation IV International Forum*—an international collective of 10 leading nations and the European Union's Euratom—dedicated to development of next generation advanced nuclear energy technologies.

Under the direction of Mr. Magwood, the office has reasserted a leading role for the United States in the international discussion regarding the future use of nuclear power technology to generate secure supplies of energy without emitting air pollutants that can damage the environment, both regionally and globally. His contributions to the advancement of nuclear technology have been recognized internationally; in 2003, he was elected Chairman of both the Generation IV International Forum and the Paris-based OECD Steering Committee on Nuclear Energy.

Prior to assuming his current position, Mr. Magwood served as the Associate Director for Technology and Program Planning in the Office of Nuclear Energy, Science and Technology for four years. He also served as the Executive Secretary of the interagency Highly Enriched Uranium Oversight Committee.

From 1984–1994, Mr. Magwood held technology management positions with two energy-related organizations. He managed electric utility research and nuclear policy programs at the Edison Electric Institute, Washington, DC; and he was a scientist at Westinghouse Electric Corporation, Pittsburgh, Pennsylvania, where he analyzed radiological and hazardous waste disposal, treatment, and handling systems, and provided technical support to nuclear fuel marketing efforts.

Mr. Magwood holds a B.S. degree in Physics, and a B.A. degree in English from Carnegie-Mellon University. He also holds an M.F.A. degree from the University of Pittsburgh.

Chairman BIGGERT. Thank you very much.

Dr. Waltar, you are recognized for five minutes. If you—I think your mic is not on.

Dr. WALTAR. All right.

Chairman BIGGERT. Yeah. Thank you.

STATEMENT OF DR. ALAN E. WALTAR, DIRECTOR OF NUCLEAR ENERGY, PACIFIC NORTHWEST NATIONAL LABORATORY

Dr. WALTAR. Well, my name is Alan Waltar. I am Director of Nuclear Energy at Pacific Northwest National Laboratory and an employee of Batelle, which operates PNNL for the Department of Energy. I mention this up front, because Batelle is leading a team to bid on the INL contract, however, my testimony is based almost exclusively on my nearly four years—four decades of activity in the nuclear profession, largely uncoupled with Batelle. And further, I am not a member of the Batelle team working on the bid proposal. Rather, I come to you having formerly served as professor and Head of the Department of Nuclear Engineering in Texas A&M, and prior to that, 25 years with Westinghouse Hanford Company in roles associated with advanced reactor design and operation. As you mention, I also had the privilege of serving as President of the American Nuclear Society, an experience that allowed me to become aware of the vital global contributions that nuclear energy, when properly developed and managed, can make to the advancement of a civilization.

Because of time constraints, I plan to stress in my oral presentation the major driving forces that justify, in my mind, the creation of the new Idaho National Laboratory, and I have included responses to the questions in the written testimony.

Access to abundant and affordable supplies of energy is crucial to development, and is the driving force behind our economy and our national security. Now given this reality, when a large and growing portion of our energy supply is embedded in unstable regions of the world, a monumental price must be paid, monetarily, politically, and yes, even militarily. Even more sobering, nations without access to adequate energy supplies remain chronically underdeveloped, thereby providing the breeding grounds for terrorism to fester and grow in retaliation to the wealthy of the world. Finally, there is mounting evidence that in our quest for additional energy supplies we need to significantly reduce the emission of greenhouse gases that contribute to global warming.

So in response to this situation, I believe the United States must: number one, drastically reduce its dependence on foreign oil, particularly the Middle East; two, develop domestic energy sources capable of sustainable development that are consistent with environmental stewardship; and three, work to substantially reduce the stark differences in quality of life among the peoples of the world.

In my judgment, the only source of energy capable of credibly responding to the situation, in the time frame we have, is nuclear energy. True, essentially all sources of energy will be needed, but it is only wishful thinking to assume that the growth in our longer-term worldwide energy requirements can be provided by a combination of conservation, fossil fuels, and renewables. It simply can not be done.

It is within this context that I welcome the potential for adopting a national energy policy that embraces new major commitment to the development of nuclear energy. I am likewise pleased that the Department of Energy has designated the new Idaho National Laboratory to be the focal point for advanced reactor and fuel cycle development. This is the site where over 50 new reactor concepts were built and tested. These developments provide a signal that our Nation recognizes the steps necessary to provide the global leadership needed to enable nuclear technology to play the role that only it can play.

However, it is also my judgment that this new commitment can succeed only if the following support is provided. Number one, a substantial increase in sustained funding. Benefits to be derived from a robust commitment to advanced nuclear science and engineering, including the Next Generation Nuclear Power Plant as a central focus, are enormous. The higher efficiencies projected from this reactor for both the production of electricity and hydrogen, a key new energy carrier to replace petroleum transportation, are essential components of a successful energy policy. Attaining a capability where advanced nuclear science is balanced with other energy sources justifies an annual commitment in the range of $300 million to $500 million over the next few years, as noted in the April 2003 six laboratory group plan entitled “Nuclear Energy: Power for the 21st Century.” And that is attached to my written testimony.

Two, whereas the focus of the project should be at INL, I would recommend that full advantage be taken of the six laboratory directors' report, which represents a solid commitment from the directors of key national laboratories to fully integrate the technical resources, that is the staff and facilities, required to assure success in restoring U.S. leadership in nuclear technologies. These six labs, which have been expanded to seven, represent the core of our government-owned nuclear capabilities currently existing in our Nation. These laboratories, partnered with private industry and the U.S. academic community, provide enormous potential for success.

And three, by combining the two complementary capabilities of INL and Argonne West into one integrated laboratory with a clear charter and the sustained support, a truly world-class national laboratory can be created, capable of attracting both onsite talent and engaging the talent remaining at the other national laboratories, academic institutions, and private industry to fully integrate the programs needed to assure the U.S. with the energy source so vital to our future.

By integrating the current Gen-IV, Advanced Fuel Cycle Initiative, and Nuclear Hydrogen Initiative into a coherent effort focused at INL but utilizing the best talent the Nation has to offer, the U.S. can, indeed, lead the world in developing the next generation of nuclear power plants, including the fuel cycles necessary to minimize reactor waste.

And finally, as a former educator, I wish to stress how important it is for our Nation to build new nuclear facilities and support new nuclear research programs to attract and employ the best students that our universities can supply in the nuclear discipline. A combination of new, exciting projects, along with direct university support, is vital in ensuring an adequate supply of next generation, well-educated professionals in this important field.

Thank you very much.

[The prepared statement of Dr. Waltar follows:]

PREPARED STATEMENT OF ALAN E. WALTAR

Madame Chairman and distinguished Members,

My name is Alan Waltar. I am Director of Nuclear Energy at the Pacific Northwest National Laboratory and an employee of Battelle, which operates PNNL for the Department of Energy. I mention this up front, since Battelle is leading a team to bid on the new INL contract. However my testimony is based almost exclusively on my nearly four decades of activity in the nuclear profession, largely uncoupled with Battelle. Further, I am not a member of the Battelle team working on the INL bid proposal.

I come to you having formerly served as Professor and Head, Department of Nuclear Engineering, Texas A&M University, and prior to that some 25 years with Westinghouse Hanford Company in a variety of scientific and management roles associated with advanced nuclear reactor design and operation. I also had the privilege of serving as President of the American Nuclear Society, an experience that has allowed me to become aware of the vital global contributions that nuclear energy, properly developed and managed, can make to the advancement of civilization.

Because of time constraints, I plan to stress in my oral presentation the major driving forces that justify the creation of the new Idaho National Laboratory. I have included responses to specific questions in the attached written testimony.

Access to abundant and affordable supplies of energy is crucial to development and it is the driving force behind our economy and our national security system. Given this reality, when a large and growing portion of our energy supply is embedded in unstable regions of the world, a monumental price must be paid—monetarily, politically, and even militarily. Even more sobering, nations without access to adequate energy supplies remain chronically underdeveloped—thereby providing the breeding grounds for terrorism to fester and grow in retaliation to the wealthy of the world. Finally, there is mounting evidence that in our quest for additional energy supplies we need to significantly reduce the emission of greenhouse gases that contribute to global warming.

In response to this situation, I believe the United States must:

1. Drastically reduce its dependence on foreign oil (particularly from the Middle East);
2. Develop domestic energy supplies capable of sustainable development that are consistent with environmental stewardship; and
3. Work to substantially reduce the stark differences in quality of life among the peoples of the world.

In my judgment, the only source of energy capable of credibly responding to this situation in the timeframe we have available is nuclear energy. True, essentially ALL sources of energy will be needed. But it is only wishful thinking to assume that the growth in our longer-term, world-wide energy requirements can be provided by a combination of conservation, fossil fuels, and renewables. It simply cannot be done.

If we as a nation do nothing to advance the safety, economy, and proliferation protection for the next generation of nuclear reactors, we will miss a great opportunity to ensure a viable future of global nuclear energy deployment. As a consequence, we will leave our economy and environment hostage to increasing fluctuations and the unavoidable degradation that comes with relying so heavily on a fossil fuel future.

It is within this context that I welcome the potential for adopting a national energy policy that embraces a major new commitment to the development of nuclear energy. I am likewise pleased that the Department of Energy has designated the new Idaho National Laboratory to be the focal point for advanced reactor and fuel cycle development—the site where over 50 new reactor concepts were built and tested. These developments provide a signal that our nation recognizes the steps necessary to provide the global leadership needed to enable nuclear technology to play the role that only it can play.

However, it is also my judgment that this new commitment can succeed only if the following support is provided:

1. A substantial increase in sustained funding. The benefits to be derived from a robust commitment to advanced nuclear science and engineering, including the Next Generation Nuclear Plant (NGNP) as a central focus, are enormous. The higher efficiencies projected from this reactor for the production of both electricity and hydrogen (a key new energy carrier to replace petroleum for transportation), are essential components of a successful energy policy. Attaining a capability where advanced nuclear science is balanced with other energy sources justifies an annual commitment in the range of \$300M to \$500M over the next few years, as noted by the April 2003 Six Laboratory Group plan "Nuclear Energy: Power for the 21st Century" (attached).
2. Whereas the focus of the project should be at INL, I would recommend that full advantage be taken of the "Six Laboratory Directors' Report," which represents a solid commitment from the directors of key national laboratories to fully integrate the technical resources (staff and facilities) required to assure success in restoring U.S. leadership in nuclear technology. These six labs, now expanded to seven, (including Argonne National Laboratory, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, and the current Idaho Nuclear Engineering and Environmental Laboratory) represent the core of government-owned nuclear capabilities currently existing in our nation. These laboratories, partnered with private industry and the U.S. academic community, provide enormous potential for success.
3. By combining the two complementary capabilities of INEEL and ANL–W into one integrated laboratory, with a clear charter and sustained support, a truly "World Class" national laboratory can be created—capable of attracting both on-site talent and engaging the talent remaining at other national laboratories, academic institutions, and private industry to fully integrate the program needed to assure the U.S. with the energy source so vital to our future. By integrating the current Generation IV, Advanced Fuel Cycle Initiative, and Nuclear Hydrogen Initiative programs into a coherent effort, focused at INL but utilizing the best talent the Nation has to offer, the U.S.

can, indeed, lead the world in developing the next generation nuclear power plants, including the fuel cycles necessary to minimize reactor waste.

4. As a former educator, I wish to stress how important it is for our nation to build new nuclear facilities and support new nuclear research programs to attract and employ the best students that our universities can supply in the nuclear discipline. A combination of new, exciting projects, along with direct university support, is vital in ensuring an adequate supply of next generation, well educated professionals in this important field.

Now to the specific questions posed:

1. What should the U.S. goals be in the field of nuclear power? How can the new Idaho National Laboratory best contribute to those goals?

Response: I believe the testimony written above provides the major part of my answer. As a target, I believe an aggressive goal would be for half of the electricity produced in the U.S. in the year 2050 to be supplied by nuclear energy and as much as 25 percent of the U.S. transportation fuels supplied by nuclear-generated hydrogen by 2050. These are extremely ambitious goals, but I believe we should strive hard to meet them. A strong Idaho National Laboratory, properly staffed and funded, is essential to providing the leadership necessary to allow these ambitious but important goals to be met.

2. Are there gaps in the Department's present nuclear energy research and development (R&D) portfolio? Are there current research programs you would recommend discontinuing? If so, please explain your recommended changes.

Response: I believe the current framework is satisfactory. The problem is that the funding is so anemic that very little actual progress is possible. One of the great tragedies is the continuing erosion of the national nuclear infrastructure. Prime examples include the shutdown and decommissioning of the Experimental Breeder Reactor-II (EBR–II) and the Fast Flux Test Facility (FFTF), the newest reactor in the DOE complex. With the combined demand for transmutation of objectionable isotopes (to extend the lifetime of Yucca Mountain), and the longer-term needs to extract considerably more energy from uranium, a new fast spectrum reactor will have to be built—at a cost of at least $2 billion. Losses of this nature cannot, in my judgment, continue if the U.S. is serious about its commitment to nuclear power. I also believe that such losses provide an unacceptable trend in reducing the capacity of our nation to produce isotopes for medical, agricultural, and industrial purposes. Over 90 percent of the life-saving medical isotopes currently used in the United States come from abroad.

3. The Department is working in partnership with the nuclear power industry to enable a new nuclear plant to be ordered and licensed for deployment within the decade. Is the nuclear energy R&D portfolio adequate to meet this goal? If not, how could this be rectified?

Response: The current R&D program is probably adequate to support the 2010 new commercial nuclear initiative. What is needed are sufficient federal incentives to overcome the risks that any utility (or utility consortium) would have to bear in constructing a new plant—particularly if the plant were to be located in an unregulated market. The utilities MUST have federal incentives or some type of guaranteed return in order to reduce the financial risks to commercial acceptability for the first new plant order. Incentives could include a carbon tax credit, a guarantee for the price of electricity for a time long enough to amortize the cost of construction, or other ways to allow the private sector to step up to the plate.

4. The Next Generation Nuclear Plant (NGNP) has been described both as a demonstration of commercial viability and as a research test bed. What is your view of the purpose of the NGNP? To what extent is the design of the NGNP being influenced by the requirements imposed by hydrogen production? To what extent will INL be capable of world leadership in nuclear energy R&D if the Next Generation Nuclear Plant (NGNP) does not go forward?

Response: I believe the principal purpose of the NGNP is to serve as an advanced testbed to demonstrate high temperature operation (both for higher efficiency electricity production and for the production of hydrogen). However, requesting private participation in designing and building the plant represents a first and important step to inject strong commercial potential for the plant. Certainly the projection of hydrogen is a strong driving force for the particular design underway—and this is important, since our nation MUST find a way to drastically reduce the need for oil, and hydrogen represents a very distinct alternative energy carrier. But if the NGNP is not funded and built, the INL will not be able to serve as a world class laboratory. It simply will not be able to draw the talent necessary to achieve such distinction.

Thank you very much.

Nuclear Energy: Power for the 21st Century
An Action Plan

Energy is vital to human civilization. It underpins national security, economic prosperity, and global stability. As the world's most powerful and prosperous nation, the U.S. must lead the way in developing a diverse energy system that can meet rapidly growing world energy demand in a way that promotes peace, prosperity, and environmental quality. This diverse energy system must include a growing component of nuclear energy.

In July 2002, the Directors of six Department of Energy (DOE) national laboratories wrote to the Secretary of Energy to urge DOE to "*implement a comprehensive and integrated plan to further the development of nuclear energy and the management of nuclear materials*." Such a plan can help achieve the Laboratory Directors' vision:

Vision:
Sustainable peace, prosperity, and environmental quality, enabled through immediate U.S. leadership in the global expansion of nuclear energy systems.

DOE has taken aggressive and commendable steps to ensure that nuclear energy plays a large role in our energy future. After the July 2002 letter, DOE asked the Laboratory Directors to provide specific recommendations regarding what strategic directions should be followed to enable an expanded use of nuclear energy. The letter had called for the Secretary to "*accelerate and enhance Departmental nuclear energy, reactor waste and nuclear materials management programs:*

- *To assist the deployment by U.S. industry of multiple new power plants by 2020;*
- *To reduce actinide waste and plutonium stockpiles by closing the fuel cycle;*
- *To restore the industrial and R&D infrastructures;*
- *To provide technologies and strengthen the regime for safeguards integrated within existing and advanced fuel cycles; and*
- *To provide sustainable energy sources that mitigate global climate change and water availability issues.*"

This Action Plan responds to DOE's request. The Plan builds on the recommendations of the July 2002 letter by setting three challenging goals with associated objectives and enabling actions. Following the goals are specific proposals for accelerating and enhancing DOE's nuclear energy programs in the near-term to place the U.S. on a path to achieve the goals.

Goal #1: Reduce air pollution and global climate risk and improve energy security by meeting an increasing fraction of future US and world energy needs through safe and economic nuclear energy solutions

Objective: 50% of U.S. electricity produced by nuclear power and 25% of U.S. transportation fuels supplied by nuclear-generated hydrogen by 2050
Enabling Actions:

- As envisioned by the Administration's National Hydrogen Energy Roadmap, undertake R&D to develop a hydrogen fuel system including production, storage, distribution and use
- Commit in 2004 to build a gas-cooled reactor to demonstrate nuclear-hydrogen and electricity production, and complete construction by 2010-2012
- Demonstrate advanced nuclear-hydrogen production process technology (in a non-nuclear facility) by 2006, to support the gas-cooled reactor project
- Enable industry to place an order for at least one new nuclear power plant by 2008

- Build a next-generation, fast-spectrum liquid metal-cooled nuclear power plant in the U.S. by 2020, for the purpose of electricity production and nuclear materials management

Estimated Cost: $5B

Objective: Cooperatively develop internationally deployable systems to enable 10 to 15% of world energy to be produced by nuclear means by 2050 (with systems that are proliferation-resistant, economic, safe, sustainable, and physically protected)

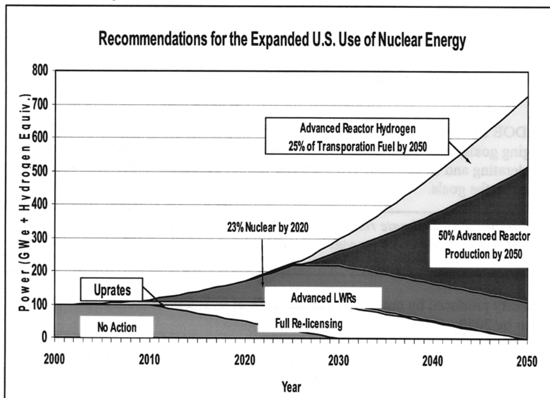
Enabling Actions:

- Develop international cooperative programs by 2005 to allow increased international deployment of nuclear systems
- Strive to implement a U.S.-Russian agreement for cooperative research consistent with the commitment from the Bush-Putin summit.
- Work with international partners to jointly build a next-generation nuclear power plant abroad by 2025

Estimated Cost: $0.5B for initial technology development support

Achieving this goal will have the benefits of:

- Reducing U.S. carbon dioxide emissions by 3 billion metric tons per year and world carbon dioxide emissions by up to 6 billion metric tons per year by 2050 (current U.S. carbon dioxide emissions from energy consumption are about 6 billion metric tons per year),
- Enhancing energy security by replacing oil with nuclear-generated hydrogen for transportation use. This will reduce U.S. oil consumption by 2 billion barrels per year and world consumption by up to 3 billion barrels per year by 2050 (current U.S. oil consumption for transportation is about 4.6 billion barrels per year), and will help stimulate U.S. demand for fuel cell vehicles,
- Rejuvenating the U.S. nuclear infrastructure, and
- Advancing U.S. leadership in nuclear technology and providing significant commercial opportunities for U.S. industry



Benefits:

- Reduce U.S. CO2 emissions by 3 billion metric tons per year
- Reduce U.S. oil consumption by 2 billion barrels per year
- Achieve a 90% reduction in reactor waste requiring repository disposal
- Enabling the technology for nuclear energy to be an energy resource for centuries
- Consume 50% of the inventory of plutonium in U.S. used fuel

To realize a strong nuclear contribution to global energy security – in both electrical generation and the production of hydrogen for transportation with attendant nuclear materials management – strategic R&D investments are needed now

Goal #2: Achieve a 90% reduction of reactor waste requiring repository disposal by 2050 by significantly reducing the amount of uranium, plutonium, and minor actinides in disposed waste

Objective: Demonstrate a closed fuel cycle technology system by 2020
Enabling Actions:
- Build a pilot facility to demonstrate advanced technology for partitioning waste and recycle by 2010
- Build a pilot fuel supply and testing facility by 2010
- Demonstrate actinide burning in an advanced system by 2020

Estimated Cost: $2B

Achieving this goal will have the benefits of:
- Eliminating the technical need for a second repository in this century,
- Compared with the once-through fuel cycle, achieving a 50% reduction of plutonium inventories in U.S. used fuel, and
- Enabling the technology to sustain the nuclear energy supply for centuries

Goal #3: While expanding the use of nuclear technology world wide, reduce the threat of nuclear weapons proliferation

Objective: By 2020, demonstrate a global nuclear energy technology system consisting of intrinsic and extrinsic safeguards that minimizes proliferation risk
Enabling Actions:
- Develop and sustain an analytical framework and standards for quantifying integrated proliferation risk by 2005
- Accelerated development of affordable technologies and multilateral transparency systems from cradle to grave with an integrated demonstration by 2008
- Recommend an international framework for implementing sustainable global management of nuclear materials and services by 2008

Estimated Cost: $1B

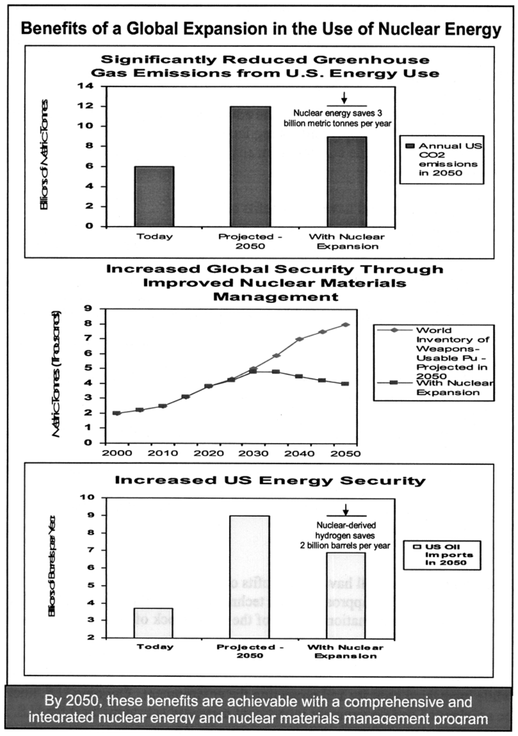
Achieving this goal will have the benefits of:
- Establishing U.S. approaches and technology as world standards for proliferation resistance by 2015, and
- Enabling the elimination of 50% of the world stock of weapons-capable plutonium by 2035

These challenging goals require that the U.S. significantly increase its investment in nuclear energy technology development. U.S. leadership in this area is critical to meeting growing world energy needs while increasing security and protecting the environment. Ongoing U.S. nuclear energy R&D programs must be accelerated and government investment increased substantially if the U.S. is to be on a path to meet the goals.

The Laboratory Directors recommend four specific actions to be taken in the near-term:

1. **Provide significant incentives for-near-term deployment of new nuclear power plants in the U.S. -** If new nuclear power plants are to be built in the U.S., the financial risk of new construction must be reduced. An in-depth analysis by Scully Capital Services concluded that once the first several plants have been built and operated, new nuclear power plants can be fully competitive in the marketplace. Through the Nuclear Power 2010 program, DOE is working with industry to reduce regulatory and other uncertainties. Sustained investment in this program is warranted, as are additional measures by the Administration and Congress to help industry manage the financial risk of the first several new nuclear plants.

2. **Develop and demonstrate advanced Generation IV reactor systems that can support a major expansion of nuclear energy – for both electricity production and generation of hydrogen for transportation – in the first half of the 21st century** – A substantial increase in investment in research and development is required to support a decision in 2004 to construct a nuclear high-temperature reactor hydrogen production demonstration; a timely demonstration of hydrogen production technology (using a non-nuclear heat source) by 2006; and construction of a demonstration reactor by 2010 to 2012. The schedule for development of liquid metal-cooled fast reactor technology should be accelerated and the investment should be increased to enable down-selection to a single fast reactor system by 2010, leading to demonstration by 2020. When possible, expand international cooperation to include Russia which has significant experience with several of the reactor concepts under consideration in Generation IV. DOE should also consider increasing its investment in research leading to the deployment of nuclear energy technologies for other process heat applications, including the production of clean water to respond to this growing world problem.

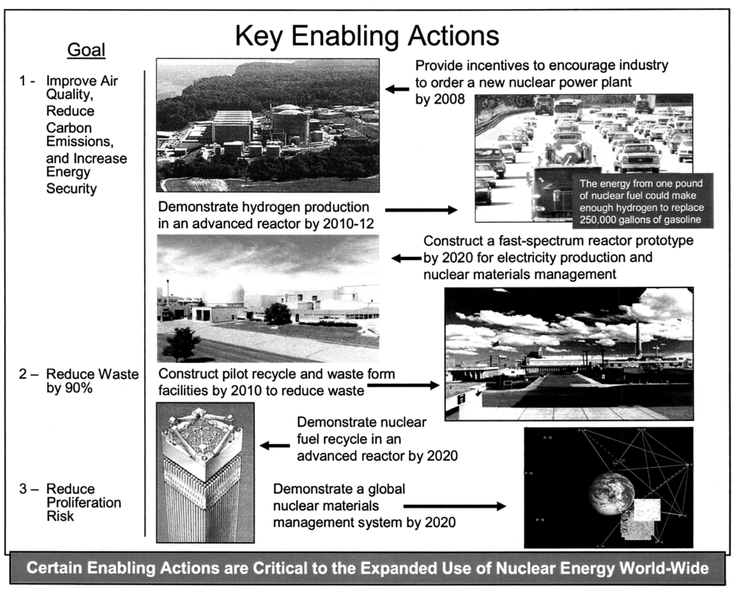


3. **Develop and demonstrate closed fuel cycle technology to produce an economically, socially, and politically sustainable fuel cycle of the future** – The Advanced Fuel Cycle Initiative must be accelerated to put the U.S. in a position to make informed, timely decisions regarding the future nuclear fuel cycle. A closed fuel cycle will be required to enable a large-scale, sustainable expansion of nuclear energy. A multi-technology approach is required, culminating in the construction of a flexible pilot recycle and waste form plant by 2010 that demonstrates commercial viability.

4. **Demonstrate technology that will set the world standard for proliferation prevention** – New technologies are needed in the areas of the global management of nuclear materials; development of fuels, reactor materials and integrated systems that enable reduced refueling requirements and reduced attractiveness of fuel cycle materials; advanced monitoring and control systems for improved plant operations; and enhanced safeguards to provide high levels of external observability, plant protection, and information management. As a first step, metrics must be established for proliferation risk and technical approaches must be developed to achieve proliferation risk reduction. Simultaneously, initiate a program to develop advanced fuels, materials, and sensors, to reduce the availability of desirable materials that pose a diversion risk.

In the process of realizing the above goals, DOE will build new research, development, and demonstration facilities and attract new scientists and engineers to the nuclear field. This will have the natural and desirable effect of restoring the U.S. nuclear infrastructure, which has been weakened by the interruption and termination of most U.S. nuclear energy programs. Specifically, DOE will find that in achieving the goals, it will make sustained and substantial investments in the nuclear R&D infrastructure on four fronts:

- *University nuclear education*: Implement the recommendations of the Nuclear Energy Research Advisory Committee and significantly increase support for university programs.
- *National laboratory resources*: Rebuild expertise within key DOE national laboratories that have and will continue to constitute the government's core competency for nuclear technology.



- *Base Nuclear Technologies*: Support a base technology program to underpin the research programs discussed in this plan. This program will have the added benefit of encouraging more researchers to enter the nuclear field.
- *Information Preservation*: Support a concerted effort to ensure that technology developed in the past is preserved and leveraged in ongoing programs.

These steps will provide the technological base and infrastructure that will form the underpinnings necessary for the U.S. to have a future commercial nuclear enterprise.

The July 2002 letter to the Secretary called for an additional $1 billion above planned nuclear energy R&D and infrastructure investment over the next five years. This recommendation recognized that, in order to realize a strong nuclear contribution to global energy,security – in both electrical generation and the production of hydrogen for transportation – strategic R&D investments are needed now. The nuclear energy R&D program recommended herein will require a large investment in research and infrastructure, but will be well worth the investment. History is an excellent guide in this regard; the total U.S. government investment in commercial nuclear fission research and development over the past 50 years is roughly equal to the revenue from nuclear-generated electricity in the U.S. each year. To implement the recommendations in the Action Plan will require DOE's investment in nuclear energy R&D and infrastructure be increased from the present level, as follows:

	FY 2003 Approp.	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
DOE Nuclear Energy R&D and Infrastructure Investment	$152M	$250M	$300M	$350M	$425M	$500M

To accomplish the long-term goals outlined in this Action Plan will require a sustained government commitment totaling less than $10 billion. The benefits of this investment to U.S. energy security, environmental quality, and national security are substantial. The opportunity that this activity represents to provide for sustainable world peace, free from the threat of global conflicts over energy supplies and the proliferation of nuclear weapons, prosperity for the world's peoples deriving from abundant and affordable energy supplies, and protecting the global environment with clean, emissions-free nuclear energy, constitutes a legacy of leadership fully befitting the United States of America. The Directors of the Department of Energy National Laboratories remain fully committed to supporting the accomplishment of these goals.

BIOGRAPHY FOR ALAN E. WALTAR

Dr. Alan Waltar is Director of the Nuclear Energy Program at the Pacific Northwest National Laboratory. He joined the Laboratory July 1, 2002 after serving as Professor and Head of the Nuclear Engineering Department at Texas A&M University (now the largest nuclear program in the Nation).

Highly respected by the international nuclear community, Dr. Waltar is a fellow and past president of the American Nuclear Society and a member of the International Nuclear Energy Academy. He has served as a consultant to the International Atomic Energy Agency, Energy Northwest, Los Alamos National Laboratory, and the Department of Energy. Dr. Waltar chaired the 1998 Gordon Research Conference on Nuclear Waste and Energy.

Before moving to Texas in 1998, Dr. Waltar spent nearly 25 years with Westinghouse Hanford Company. His work on projects such as the regulatory approval of and subsequent safety and fuels testing in the Fast Flux Test Facility earned him a reputation as a leader in nuclear safety and technology. Dr. Waltar has authored two books, as well as more than 70 open literature publications, and is in demand as a speaker on nuclear energy and technology.

Dr. Waltar holds a doctorate in engineering science from the University of California, Berkeley, and a Master's degree in Nuclear Engineering from the Massachusetts Institute of Technology. He earned his Bachelor's degree in Electrical Engineering at the University of Washington.

Chairman BIGGERT. Thank you very much, Dr. Waltar.

Dr. Long, you are recognized for five minutes. Could you make sure that your microphone is on?

STATEMENT OF DR. ROBERT L. LONG, NUCLEAR STEWARDSHIP, LLC

Dr. LONG. I am a Ph.D. Nuclear Engineer with over 45 years of experience as a researcher, academic, and nuclear utility company executive.

In 2002 and 2003, I served as chair of the NERAC Infrastructure Task Force that was asked to advise the Department of Energy concerning the maintenance, upgrade, and reconstruction needs of the Idaho National Laboratory, actually INEEL and ANL West at that point in time. The Infrastructure Task Force was made up of the following members: myself, as Chair; Dr. Mike Corradini, Chair of Nuclear Engineering at the University of Wisconsin in Madison; Dr. Jose Cortez, Chair of Physics and Geology at the University of Texas, Pan-American; Dr. Warren Miller, Deputy Director, retired, from Los Alamos National Lab; and Dr. Allen Sessoms, President of Delaware State University.

The task force reviewed extensive materials from DOE, the INEEL, and the ANL West, and on November 6 through 8, 2002, we visited the Idaho site, received briefings and tours of the facilities. The task force report was submitted to the DOE on January 16, 2003, accepted by NERAC at their meeting in November of 2003, and formally transmitted to the Secretary of Energy in May 2004. That report included an overview of the Idaho site and facilities, including more detailed comments on key facilities. At the time of the task force effort, it was not known that INEEL and ANL West were to be combined into a new entity to be designated as Idaho National Laboratory. Members of the task force fully endorsed that decision to combine the laboratories under a single management structure.

Our primary conclusions and recommendations are included in my written testimony. I will highlight just a few.

The task force believes that it is significantly important for DOE to have designated a lead laboratory for nuclear energy research and development. For the Administration to go forward with nuclear energy beyond 2010, the lead lab site at Idaho requires an immediate and significant increase in funding to just, for example, clean up maintenance backlog and make key mission—key facilities mission ready. University participation by faculty and students should be a basic element of any nuclear energy beyond 2010 R&D. And certainly to optimize the use of facilities and staff resources, facilities beyond the Idaho site, but in the U.S., that is the other national laboratories and international sites in the Gen-IV partner countries, should be integrated into the nuclear energy R&D plans. Given the designation of INL as the lead nuclear energy R&D laboratory, an external review process for laboratory activity should be established, independent of NERAC, I think, and far more active than NERAC in this particular area. There should be broad representation of stakeholders, universities, other laboratories, international partners, and other interested groups.

The Subcommittee asked me to address three questions. I will focus on just two. The others are addressed in my written testimony.

The first was: "What role do you recommend that ANL and other national labs play in nuclear energy R&D?" Given the wide range of nuclear energy R&D endeavors, active and careful coordination will be required with other DOE laboratories and universities that are providing leadership as well as crucial research support. It is essential that DOE and the new INL contractor effectively integrate into the nuclear energy R&D mission the facilities and staff of universities, international partners, and other national laboratories. It is clear that DOE Office of Science and NNSA-funded laboratories are engaged in significant nuclear energy R&D activities. Strong direction from the Secretary of Energy will be needed to ensure appropriate allocation of resources across this wide spectrum of activities.

One of the questions, in part, asked: "To what extent will INL be capable of world leadership in nuclear energy R&D if the Next Generation Nuclear Plant does not go forward?" One of the characteristics common to all—to many, but not all, world-class laboratories is the presence onsite of a user facility. Once up and operating, the NGNP, I believe, would not be seen as a user facility. However, there are other research facilities that could be pursued in the event that NGNP does not go forward. An example might be becoming the center of excellence for the facilities needed to lead the Advanced Fuel Cycle Initiative. Thus I believe that INL will be capable of world leadership in nuclear energy R&D whether or not the NGNP goes forward.

Finally, the key to becoming a world-class laboratory is the presence of an underlying, long-term commitment to excellence and assured funding of both facilities and human resources. At a time when our national resources are severely challenged, I believe that DOE and OMB will need to make major changes in the allocation of DOE resources to fund the development of a world-class nuclear energy R&D laboratory at Idaho.

[The prepared statement of Dr. Long follows:]

PREPARED STATEMENT OF ROBERT L. LONG

My name is Robert L. Long. I am a Ph.D. Nuclear Engineer with over 45 years experience as a researcher, academic and nuclear utility company executive. I am a charter member of the U.S. DOE Nuclear Energy Research Advisory Committee (NERAC). In 2002–2003 I served as Chair of the Infrastructure Task Force (ITF) that was asked to advise the Department of Energy concerning the maintenance, upgrade and new construction needs of the Idaho National Energy and Environmental Laboratory (INEEL), including Argonne National Laboratory-West (ANL–W), as DOE's lead nuclear energy laboratory. The Infrastructure Task Force (ITF) was made up of the following members:

Robert L. Long, ITF Chair, Owner, Nuclear Stewardship, LLC

Michael L. Corradini, Chair, Nuclear Engineering, University of Wisconsin-Madison

Jose L.M. Cortez, Chair, Physics and Geology, University of Texas Pan American

Warren F. Miller, Jr., Deputy Director (retired), Los Alamos National Laboratory

Allen L. Sessoms, President, University of Delaware

After receiving extensive written materials from DOE, the INEEL and ANL–W, on November 6–8, 2002 the ITF visited the Idaho site and received briefings and tours of the facilities. After ITF review, INEEL and ANL–W provided updated facility descriptions that were used in the preparation of the ITF Report. On January 7–8, 2003 the ITF met in Albuquerque, NM to complete their Report which was then submitted to the DOE on January 16, 2003. The Report was accepted by NERAC at their meeting in November 2003 and formally transmitted to the Secretary of Energy in May 2004.

The Task Force Report includes an overview of the Idaho site and facilities, including more detailed comments on a few key facilities. Another section discusses a number of human resource and staff issues. At the time of the Task Force effort it was not known that INEEL and ANL–W were to be combined into a new entity to be designated as Idaho Nuclear Laboratory. So, the Report includes a discussion of the relationships and memoranda of understanding and agreement between the two laboratories. Members of the Task Force fully endorse the decision to combine the laboratories under a single management structure. While there was not time to examine the roles of universities and other DOE laboratories in the nuclear energy R&D missions of DOE, the Task force devoted a section of the Report to this important topic.

The primary conclusions reached by the ITF are:

- It is significant and important for DOE to have designated a lead laboratory for nuclear energy research and development.
- The funding at the Idaho site, given the lead-lab status is clearly insufficient.
- If Idaho site facilities are to be used for the proposed missions (e.g., Advanced Fuel Cycle Initiative, Generation IV Reactor R&D and other nuclear energy work beyond 2010) resources must be provided at appropriate levels.
- Where appropriate resources have been made available, world-class facilities (e.g., Advanced Test Reactor, Fuel Cycle Facility) exist and are supported by top-notch staff and innovative programs.
- Conversely there are certain facilities (e.g., Fuel Processing Facility) that have lost their missions and for which significant maintenance challenges exist. These facilities should be abandoned.
- INEEL is urged to develop a facilities consolidation plan, once the NE technical mission is better defined. Note: INEEL has issued a Ten-Year Site Plan that is now available.

The most important recommendations of the ITF are:

- Given events since the *National Energy Strategy* was issued, the federal commitment to nuclear energy needs to be restated and reinforced by the White House and other senior administration officials.
- For the Administration to go forward with "nuclear energy beyond 2010" the lead lab site at Idaho requires an immediate and significant increase in funding to, e.g., clear up maintenance backlog and make key facilities mission ready.

- University participation (faculty and students) should be a basic element of "nuclear energy beyond 2010" R&D.
- Some facilities should be shut down or not considered for further development. This includes the uncompleted Fuel Processing Facility. There may be others such as the Flourinel Dissolution Process Cell (FDP).
- New facilities will probably be needed for the purposes of "nuclear energy beyond 2010." This may include a source of fast neutrons, among others. It is recommended that a specific study be conducted to determine the need for steady and transient fast neutron facilities in the U.S. This study should consider accessibility of existing support facilities.
- To optimize the use of facilities and staff resources, facilities beyond the Idaho site, but in the U.S. (e.g., ANL–E, Oak Ridge, and Savannah River), and international sites in the Gen IV partner countries should be integrated into nuclear energy R&D plans.
- Given the designation of INL as the lead nuclear energy R&D laboratory, an external review process for laboratory activities should be established. There should be broad representation of stakeholders from universities, other laboratories, international partners, and others.

The Energy Subcommittee asked that the following questions be addressed:

1. What role do you recommend that Argonne National Laboratory and other national laboratories with nuclear expertise play in nuclear energy R&D after the Idaho National Laboratory (INL) is established?

The DOE Office of Nuclear Energy has aggressively expanded its research and development missions to encompass a wide range of topics, such as:

- Advanced Fuel Cycle Initiative (Series 1 and Series 2),
- Generation IV Roadmap and associated Advanced Reactor Design,
- Nuclear Energy Research Initiative (NERI and INERI) for basic studies,

These initiatives along with service to NASA and the Navy in nuclear energy activities encompass what might be called "Nuclear Energy Beyond 2010."

Such a wide range of endeavors requires active and careful coordination with other DOE laboratories and universities that are providing leadership as well as crucial research support. It is essential that DOE and the new INL contractor effectively integrate into the NE R&D mission the facilities and staff of universities, international partners, and other national laboratories, e.g., ORNL, ANL–East, Savannah River, and Hanford. It is clear that DOE Office of Science and NNSA funded laboratories are engaged in significant nuclear energy R&D activities. Strong direction from the Secretary of Energy will be needed to ensure appropriate allocation of resources across this wide spectrum of nuclear energy R&D activities.

Given the assignment of INL as the lead nuclear energy R&D laboratory the DOE should move quickly to establish an external review process for laboratory activities to assist in strategic planning and missions coordination.

2. The Department has indicated that INL will be a multi-purpose laboratory, but the current strategic plan for the Idaho National Engineering and Environmental Laboratory emphasizes the laboratory's transition to a focus on nuclear related research. What specific programs should the Department support at INL beyond nuclear and environmental management related research?

NERAC has another subcommittee, of which I am a member, that is looking at characteristics of world class laboratories and what will be needed to have INL reach world class level over the next ten years. One issue is whether INL should be a multi-purpose laboratory or be singly focused on nuclear energy R&D. For example, we have asked whether the Homeland Security mission will detract from the ability to become world class in nuclear energy R&D. The Subcommittee has raised an important question. I will need further discussions with my NERAC colleagues before I will feel competent to identify specific programs that should be supported beyond nuclear and environmental management related research.

3. The Next Generation Nuclear Plant (NGNP) has been described both as a demonstration of commercial viability and as a research test bed. What is your view of the purpose of the NGNP? To what extent is the design of the NGNP being influenced by the requirements imposed by hydrogen production? To what extent will INL be capable of world leadership in nuclear energy R&D if the Next Generation Nuclear Plant (NGNP) does not go forward?

I believe that the NGNP is a needed step in demonstrating the capability to economically produce hydrogen as an alternative to the burning of fossil fuels. The design of the NGNP is driven by the requirements imposed by hydrogen production, that is, the need for substantially higher temperatures than those available from the current generation of light water reactors. The higher temperatures will also increase the efficiency of electrical generation. The R&D needed to bring the NGNP to fruition will be demanding and should attract world class staff to be involved in the project.

One of the characteristics common to many, but not all, of the world class laboratories that our NERAC subcommittee members have visited is the presence on site of a user facility. Once up and operating the NGNP would not be seen as a user facility. There are other research facilities that could be pursued in the event the NGNP does not go forward, e.g., sources of steady state and transient fast spectrum neutrons. Another might be becoming the center of excellence for the facilities needed to lead the Advanced Fuel Cycle Initiative.

Thus, I believe that INL will be capable of world leadership in nuclear energy R&D whether or not the NGNP goes forward.

A commitment to substantial long-term funding. In every discussion and every reference reviewed by the current subcommittee, the key to becoming a world class laboratory is the presence of an underlying long-term commitment to excellence and assured funding of both facility and human resources. DOE has taken a step in that direction by specifying that the new contactor for INL will have a ten-year contract term, conditioned on satisfactory performance. At a time when our national resources are severely challenged, I believe that DOE and OMB will need to make major changes in the allocation of DOE resources to fund the development of a world class nuclear energy R&D laboratory at INL.

BIOGRAPHY FOR ROBERT L. LONG

Dr. Robert L. Long is owner and sole member of Nuclear Stewardship, LLC providing consulting services in nuclear and industrial health and safety, quality assurance, management and leadership. At the end of 1996 he retired from 20 years service in the nuclear power industry, serving as a vice president for 15 of those years. His responsibilities included human resources and technical support services in training, nuclear safety assessment, quality assurance, environmental affairs, licensing and regulatory affairs, radiological safety, emergency preparedness, and construction and maintenance. Joining General Public Utilities (GPU) in 1978, he was actively involved in the response and recovery from the Three Mile Island-2 accident and the restart of TMI–1. Before joining GPU, he was Professor and Chair of Chemical and Nuclear Engineering at the University of New Mexico. In a career spanning 45 years he has served on numerous advisory and review committees for the Electric Power Research Institute, Nuclear Energy Institute, Edison Electric Institute, Accreditation Board for Engineering and Technology, Institute of Nuclear Power Operations, National Science Foundation, American Nuclear Society, National Academy of Sciences, universities, Department of Energy (DOE) and DOE contractor laboratories. He is a charter member of the DOE Nuclear Energy Research Advisory Committee and is serving in his third two-year term. Dr. Long holds M.S.Engr. and Ph.D. degrees in Nuclear Engineering from Purdue University. He is a Fellow and Past President (1991–92) of the American Nuclear Society. In 1993 he was named a Distinguished Engineering Alumnus of Purdue University.

Robert L. Long, Ph.D.
Nuclear Stewardship, LLC
9615 Elena Drive, NE
Albuquerque, NM 87122

June 18, 2004

Energy Subcommittee Chair
Committee on Science
US House of Representatives
Washington, DC 20515

Dear Subcommittee Chair:

The Department of Energy provides travel and expenses for the work performed as a member of the Department of Energy Nuclear Energy Advisory Committee (NERAC) and its task forces and subcommittees. This includes my travel to Washington, DC to provide testimony before the Energy Subcommittee of the Science Committee on June 24, 2004.

NERAC members do not receive any compensation or honorarium for work performed for NERAC or its task forces and subcommittees.

Sincerely yours,

/s/

Robert L. Long, Ph.D.

Chairman BIGGERT. Thank you very much, Dr. Long.
Dr. Klein, you are recognized for five minutes.

STATEMENT OF DR. ANDREW C. KLEIN, DEPARTMENT HEAD AND PROFESSOR, NUCLEAR ENGINEERING AND RADIATION HEALTH PHYSICS; DIRECTOR, RADIATION CENTER, OREGON STATE UNIVERSITY

Dr. KLEIN. Thank you very much.

My name is Andrew Klein, and I am Professor and Head of the Department of Nuclear Engineering and Radiation Health Physics at the Oregon State University. I am also the Director of the Radiation Center at Oregon State University, which, as such, puts me responsible for operating research reactors. So I just wanted to bring that out, too. I am also Chair of Department of Energy's NERAC Subcommittee on Nuclear Laboratory Requirements, and according to the Department's charge to our subcommittee, a key Department of the Energy objective is to make Idaho National Laboratory the leading nuclear energy research laboratory in the world in 10 years after conception. Furthermore, our subcommittee is in charge of identifying the characteristics, capabilities, and attributes that a world-class nuclear laboratory would possess. And the Department has asked us to report our conclusions or recommendations by the end of fiscal year 2004. I expect it is going to be a very busy summer for my Subcommittee.

We have assembled an experienced and dedicated group of nuclear science and engineering professionals, including members with backgrounds from the nuclear power industry, academia, and the national laboratories. Members of the Subcommittee are: Dr. Beverly Hartline, who has held leadership roles at the Argonne and Jefferson National Laboratories; Dr. Long, to my right, who joins us today; Dr. Robert Schock, who has extensive experience at the Livermore National Laboratory; and Dr. Michael Sellman, who is President and Chief Executive Officer of the Nuclear Management Corporation. Since our subcommittee has a long way to go before we finish our report, I want to stress that my comments here today are my own and not necessarily those of, certainly, the Subcommittee nor NERAC itself.

We are conducting a literature review as one of the first things that we decided to start with and to look at what these characteristics are. It is clear from our early studies that this is not the first time this question has been asked on a general basis, and we expect to learn quite a bit from the works of others. We also plan to visit world-class laboratories, including both nuclear energy-related and non-nuclear laboratories in the United States, Canada, Europe, Japan, and South Korea to gather information, talk with laboratory leadership, and tour a variety of world-class facilities.

Again, speaking personally and not for the entire committee, I feel that there are at least three necessary components to a world-class national laboratory, supported by a fourth, very essential, element. The first of the three is recruiting and retaining world-class people. The second is building and maintaining world-class facilities. The third is providing world-class research programs to utilize the first two. The final building block, though, of any world-class laboratory is a resolute and sustained commitment to see the task completed.

I will skip the details on some of the first three, but the final one, one comment on that is that the government's commitment to date has provided the initiative to establish the Idaho National Laboratory and must provide the sustained leadership and financial support required for the INL to meet its mission.

My personal observation, though, is that the budgets proposed for the development of this new capability are totally inadequate. Also, the proposed plan to shift funding to the cleanup operation—from the cleanup operation to the new nuclear energy R&D mission over a period of 10 years as the cleanup mission is completed seems overly optimistic. The next few years will be especially critical. What happens during the first five years of the INL will strongly determine the path that it takes to world-class status. It must be done the right way the first time.

And I have a couple of short answers to the questions you posed to me.

First, you asked me to comment on the role of Argonne National Laboratory and the other national laboratories with nuclear experience. It is my belief that all of these capabilities, and to the list of national laboratories, I would add the Nation's universities and industries with nuclear energy-related programs, will be needed to go forward if we are to fully develop nuclear energy systems that will be required to reduce our Nation's dependence on fossil fuels for electricity production and, as Dr. Waltar mentioned, transportation fuels. All three entities, the national laboratories, universities, and industry, will need to play important roles in the development of this technology.

Second, you asked my opinion about specific programs the Department should support at the INL if it was to be considered a multipurpose laboratory. First, let me believe—say that I believe that the INL should not be restricted to the focused mission of developing a nuclear reactor for electricity production or the production of hydrogen by utilizing a high-temperature reactor, the heat output from a high-temperature reactor. The INL needs a much broader mandate than this. I believe INL should be a multipurpose laboratory and it will be very important for the Department to support a broad set of research activities at the INL.

It is also going to take more than just nuclear engineers to make the INL a world-class laboratory. As you can expect from someone who has all of his degrees from nuclear engineering programs and teaches in a university nuclear engineering program himself, I highly value the skills of nuclear engineers, however, they will not be enough. Skilled scientists and engineers of all types, including computational sciences, mechanical engineers, material scientists, electrical engineers will all be needed and more.

Also, with respect to your question about NGNP, I believe that the NGNP development should be a result of creating a world-class INL and not the reverse. I don't think we should create the capability of the NGNP first. We should create the INL first.

Thank you, again, for this opportunity to talk with you about this important issue.

[The prepared statement of Dr. Klein follows:]

PREPARED STATEMENT OF ANDREW C. KLEIN

Chairman Biggert, Mr. Larson and Members of the Subcommittee, I want to thank you for this opportunity to discuss a very important aspect of the energy future of our country. My name is Andrew Klein and I am Professor and Head of the Department of Nuclear Engineering and Radiation Health Physics and the Director of the Radiation Center at Oregon State University. I also chair the Department of Energy's Nuclear Energy Research Advisory Committee's Subcommittee on Nuclear Laboratory Requirements.

According to the Department's charge to our subcommittee a "key Department of Energy objective is to make Idaho National Laboratory the leading nuclear energy research laboratory in the world in ten years from its inception." Furthermore, our subcommittee has been charged with identifying the "characteristics, capabilities, and attributes a world-class nuclear laboratory would possess". In addition, the Department expects the "members of this subcommittee to become familiar with the practices, culture, and facilities of other world-class laboratories—not necessarily confined to the nuclear field—and use this knowledge to recommend what needs to be implemented at Idaho." Finally, the Department has asked us to report our conclusions and recommendations by the end of fiscal year 2004. I expect it will be a very busy summer for our subcommittee.

We have assembled an experienced and dedicated group of nuclear science and engineering professionals for this subcommittee including members with backgrounds in the nuclear power industry, national laboratories and academia. The members of the subcommittee are Dr. Beverly Hartline, who has held leadership roles with the Argonne and Jefferson National Laboratories; Dr. Robert Long, who joins us today, was a faculty member and Department Chair at the University of New Mexico prior to joining GPU Nuclear, from where he has retired; Dr. Robert Schock, who has extensive experience at the Lawrence Livermore National Laboratory; and Dr. Michael Sellman, who is the President and Chief Executive Officer of Nuclear Management Corporation. We look forward to providing our input to the Department of Energy on what it will take to enable the Idaho National Laboratory to be considered as a "World-Class Nuclear Energy Research and Development Laboratory." However, since our subcommittee has a long way to go before we finish our report, I want to stress that my comments here today are strictly my own, and not necessarily the views of the subcommittee or the full NERAC.

Our subcommittee is conducting a literature review to learn what others consider to be the characteristics, attributes, and qualities of world-class research and development laboratories. It was clear early in our studies that this was not the first time that this question has been asked and we expect to learn quite a bit from the work of others.

We plan to visit world-class laboratories, including both nuclear energy related and non-nuclear laboratories, in the United States, Canada, Europe, Japan and South Korea to collect data, gather information, talk with laboratory leadership, and tour a variety of world-class facilities. Some of the visits that we will make during our investigation include laboratories of the Department of Defense, Department of Commerce, and other Federally Funded Research and Development Centers, in addition to many of the national laboratories within the Department of Energy complex.

We are also conducting a survey of science and engineering leaders, again both from within the nuclear community and beyond, to learn what they consider to be the key characteristics, capabilities and attributes of a world-class nuclear energy research and development organization. One of the items we found early in our literature review was a report from the National Research Council that established the following definition for a world-class research and development laboratory [1]:

> "A world-class R&D organization is one that is recognized by peers and competitors as among the best in the field on an international scale, at least in several key attributes."

In our visits and in our survey, we are asking numerous nuclear and non-nuclear energy leaders whether they agree with this definition, and if not, how would they change or improve it. We are also asking them what makes their laboratory world-class.

Again, speaking personally and not for the entire subcommittee, I feel that there are three necessary components to a world-class national laboratory, supported by a fourth essential element. The first three are: recruiting and retaining world-class people; building and maintaining world-class facilities; and providing world-class research and development programs to utilize the first two. The final building block of any world-class laboratory is a resolute and sustained commitment to see the task completed.

The first, and most important component of building a world-class national laboratory is attracting and keeping the very best people. The INL will need to attract the best and brightest scientists and engineers from many different technical disciplines in order to be successful. It will require not just the best nuclear scientists and engineers, but will include material scientists, chemical engineers, physicists, chemists, computational specialists and a range of other specialists who will build the base for a world-class laboratory. Attracting and retaining high caliber researchers will be challenging, especially in the early years, and it is critical that the INL take a flexible approach to get these people involved in the work of the new laboratory. The INL may need to include a wide variety of appointment types and opportunities ranging from full-time employment to part-time appointments or other collaborative appointments to consulting arrangements to be able to include the right people in this enterprise. The INL will also need to be a leader in utilizing new and expanding electronic technologies to draw people in from other geographic areas for open collaborations to enable the best ideas to be brought to the problems that INL will be tackling.

Drawing the very best people to come to work with the INL will require the second component, establishing a series of highly respected and unique user facilities. One aim here is to get researchers from universities, industry and other national laboratories to want to work with the people and facilities already sited at the INL. It is clear that the best people are attracted to working closely with other top people in outstanding facilities and locations. University faculty who are involved on research projects with the INL will bring their ideas, and more importantly their best graduate students to work with other outstanding people to make good use of the facilities and infrastructure that will be developed at INL. Some of those students will be attracted to stay after their graduation, become INL researchers themselves, and further build the INL to world-class status. The subcommittee has not been tasked with suggesting specific facilities requirements, but if you get the top people in the various disciplines related to nuclear energy development together, in very short time they will arrive at a fairly comprehensive list of needed facility improvements and the new and diverse capabilities they need.

The third component of a world-class nuclear research and development laboratory is the specific research programs that will fund the research of these top people and utilize these high quality facilities. A wide diversity of well-funded research programs will be essential to building this laboratory, and to enable the further utilization of nuclear energy for electricity and hydrogen production in this country and around the world. The diversity of programs will also be helpful going forward as budgets fluctuate with different administration priorities and other political changes in the future.

A good example of all of these components coming together to form a sustained world-class laboratory is the Jet Propulsion Laboratory, in Pasadena, CA. As you know, JPL's main line of research is the development and operation of space probes for NASA, but if you look deep inside of JPL you will see that it has all of these three elements—fantastic people, superb facilities and exciting and compelling programs and missions. It also has, on site, all of the disciplinary capabilities across the wide spectrum of research and development that they need, but they also utilize scientists and engineers from across the US to accomplish their missions. INL needs to have all of these elements to succeed in its mission.

Underneath all of this, and providing the motivation and purpose for the laboratory is a resolute and sustained commitment from the U.S. Government. This persistent support must not just be from the Office of Nuclear Energy, but needs to be encouraged by the entire Department and as much of the rest of the Government as possible. I also feel that Congress should take ownership of this new laboratory to enable it to succeed. I am very glad to participate in this discussion today, as it shows the Congress's intention to see that the INL gets started off in the right direction. The Government's commitment to date has provided the initiative to establish the Idaho National Laboratory from the two existing entities in Idaho Falls, and must provide the sustained leadership and financial support required for the INL to meet its mission.

My personal observation, however, is that the budgets proposed for the development of this new national capability are totally inadequate. Also, the proposed plan to shift funding from the clean-up operation to the new nuclear energy R&D mission over a period of ten years, as the clean-up mission is completed seems overly optimistic. The new capabilities we are trying to establish at INL need much greater focus and commitment than this. The next few years are especially critical. What happens during the first five years of the INL will strongly determine the path that it takes to world-class status. It must be done the right way, the first time.

Answers to questions from the Subcommittee

First, you have asked me to comment on the role that Argonne National Laboratory and the other national laboratories with nuclear expertise should play in nuclear energy R&D after the INL is established. It is my belief that all of these capabilities, and to the list of national laboratories I would add the Nation's universities and industry with nuclear energy related programs, will be needed going forward if we are to fully develop the nuclear energy systems that will be required to reduce our nation's dependence on fossil fuels for electricity production and transportation fuels. The national laboratories, universities and industry all will need to play important roles in the development of the technology related to this energy source and in the production of the people needed to design and operate these facilities safely and efficiently.

The Idaho National Laboratory is being established within a number of important communities, and I would like to speak here about some of these now. The support and encouragement from all of these communities will be essential to the INL's success.

The first community I would like to mention is the community of researchers and scholars who are, and will be, involved in nuclear energy related research—the primary mission of the INL. That community is an international one and the INL must develop close interactions with many, if not most of these researchers in order to get the best input and ideas in order to apply them to the problems involved in developing the systems and components needed. Since it will be impossible to lure all of these individuals to come together permanently in Idaho Falls, the INL must find creative and innovative ways to attract and retain the most important individuals and research groups to work closely with them. These individuals and groups currently reside in the national laboratories, industry, and universities, and some of them are students in our nation's K–12 school systems. Interactions with other national laboratories, industry and universities should be constant since many of the world's best nuclear energy researchers are already located at other locations. Finding creative ways to involve all of these people in the development and deployment of new nuclear energy systems will be among the important success criteria for the laboratory.

A second community is the local community in Idaho Falls and the neighboring areas. While the compelling nature of the activities being conducted by the INL will bring excitement to the lives of those working directly on the projects at the laboratory, the cultural and recreational opportunities of the local area will sustain these individuals and their families over the long run of the laboratory. It will be important for those involved to build this aspect of this second community.

A third community that will also be valuable to cultivate will be a broad set of local industrial capabilities in Idaho and the region—high tech spinoffs and imports, new and old companies, will be needed to complement the activities and capabilities to be assembled within the INL. It will be important for the INL to work closely with the State of Idaho and the City of Idaho Falls to develop the broad set of local industries which will enable the INL to attract people with the appropriate nuclear and other technical skills and their families.

The broad involvement of all of these communities will be essential to the development of the INL over its first ten years. They will be important to the development of the diversity of the knowledge base, the diversity of the talent base, and the diversity of the workforce at the INL.

Second, you have asked my opinion about specific programs that the Department should support at the INL if it is to be considered a multi-purpose laboratory. First, let me say that I believe that the INL should not be restricted to the very focused mission of developing a nuclear reactor for electricity production or the production of hydrogen by utilizing the high temperature heat output from a reactor. The INL needs a much broader mandate than this to be considered to be successful in reaching the goal of being considered world-class. Thus, I believe that the INL should be a multi-purpose laboratory and that it will be very important for the Department to support a broad set of research activities at the INL.

It is going to take more than just nuclear engineers to make the INL a world-class laboratory. As you can expect from someone who has all of his degrees in nuclear engineering and teaches in a university nuclear engineering and health physics program, I think very highly of the skills and capabilities of nuclear engineers. However, they will not be enough. Skilled scientists and engineers of all types, including computational scientists, mechanical engineers, materials scientists, chemical engineers, physicists, electrical engineers, etc. will be needed to supply the INL with the capabilities it needs to achieve its mission of reaching world-class status in 10 years.

Some of the other capabilities that I feel would be important to have at INL include computational facilities and software development, high performance materials development, applied physical sciences, including chemistry and physics, research on manufacturing modular and large system components, transportation systems for large system components and radioactive waste, and national security technology research and development related to nuclear science and technology, to name a few. All of these added capabilities are complementary to the nuclear energy and environmental cleanup technologies that are the natural programs for the INL.

World-class computational facilities will be an important draw for some of the people needed at INL. Several years ago the INEEL was one of the leaders in developing computer codes for reactor design and simulation. With the advances in computing in recent years much more is now possible—it is even conceivable that every molecule of gas flowing through a reactor core could be modeled. Leadership class computers could open up huge new areas of research in reactor design leading to entirely new approaches and conceptual designs.

High performance software development aimed at a basic principles approach to modeling could allow engineers and scientists to eliminate the use of correlations and other corrective measures in their simulations. This involves a much greater understanding of the physical and theoretical treatment of neutron interaction physics, fluid flow, heat transfer, materials interactions in these systems at the microscopic and molecular level.

Experimental capabilities are needed to verify, validate, and compare computer calculations to actual physical measurements on a variety of scales—even full-scale systems. The work in my Department at Oregon State University over more than a decade, and our close interactions with the Department of Energy, the Nuclear Regulatory Commission, INEEL, Westinghouse and others on scaled system simulation and testing of a variety of advanced nuclear reactors is a very good example of the importance of being able to compare calculations with physical measurements to ensure the accuracy of the computer codes that are used for system design, safety evaluation and licensing.

Finally, with respect to your questions about the Next Generation Nuclear Plant, or NGNP, I feel that the development and demonstration of a high temperature reactor's capabilities to efficiently produce electricity for our businesses and homes and hydrogen for our transportation needs is important to the progress of INL to world-class status. However, development of world leadership in nuclear energy development by INL should be considered to be independent of the construction and operation of the NGNP. The people, facilities, and programs at INL will be very useful to the development and operation of the NGNP. However, NGNP development should be considered a result of creating a world-class laboratory at INL, and not the reverse. Many additional multidisciplinary research facilities and capabilities will be required at INL to meet this objective. There are undoubtedly ways to design the NGNP to be a versatile, multidisciplinary research tool, rather than simply a demonstration project. This will require the involvement of the best people at the INL and across the Nation's nuclear energy R&D universities, national laboratories and industry.

Thank you, once again for this opportunity to talk with you about establishing the Idaho National Laboratory as a world-class nuclear energy research and development laboratory. I look forward to further discussions with you today, and in the future.

Reference

[1] National Research Council, "World-Class Research and Development," National Academy Press, Washington, DC, 1996.

BIOGRAPHY FOR ANDREW C. KLEIN

Andrew C. Klein became the Head of the Department of Nuclear Engineering at Oregon State University (OSU) in July 1996. In 2002 the Department's name was changed to the Department of Nuclear Engineering and Radiation Health Physics to reflect the broad nature of the activities in the Department. In October 2002 he also became the Director of the OSU Radiation Center with line responsibility for the University's 1.1 megawatt research reactor and the other facilities managed by the Center.

Dr. Klein received his B.S. in Nuclear Engineering from Pennsylvania State University in 1977. He went on to complete his M.S. in Nuclear Engineering and his

Ph.D., also in Nuclear Engineering from the University of Wisconsin, Madison in 1979 and 1983 respectively.

He has been on the faculty at OSU since September 1985 after serving as a Visiting Assistant Professor of Nuclear Engineering at the University of Cincinnati from August 1983 through August 1985. He was an Assistant Professor of Nuclear Engineering at OSU from September 1985 to July 1990 when he was promoted to Associate Professor. In July 1996 he was promoted to the rank of Professor.

His research interests are wide and varied including space reactor systems design and thermal management, transient analysis of nuclear power systems, microdosimetry, radiation shielding, the technical aspects of arms control nonproliferation, and health physics. He has also conducted research in fusion energy systems design, zircalloy corrosion and radioactive waste management. He has been an author on more than technical 75 publications in these areas.

Dr. Klein is registered as a Professional Engineer (Nuclear) in the State of Oregon. He is an active member of the American Nuclear Society, the Health Physics Society, and the American Society for Engineering Education. From August 1993 through October 2002, Dr. Klein was the Director of the Oregon Space Grant Program, a statewide consortium of universities, colleges, and other educational organizations established in 1990 by the National Aeronautics and Space Administration (NASA). He served one term on the Board of Directors of the American Nuclear Society from June 2000 to June 2003, and has served on the Advisory Committee for *Nuclear Technology* since 1997 and as an Advisory Editor for the *Annals of Nuclear Energy* since 1996. He also served on the Board of Directors of the National Space Grant Alliance, Inc. from January 2001 through October 2002. In January 2001 Dr. Klein was appointed by the U.S. Secretary of Energy to the Department of Energy's Nuclear Energy Research Advisory Committee (NERAC). Dr. Klein was also a member of USDOE's Generation IV Nuclear Energy Systems Roadmap Development team and served as the Technical Director for the Energy Products Crosscut Group in 2001 and 2002. He is a member of NASA's Space Science Advisory Committee and a member of the ABET, Inc. Engineering Accreditation Commission.

DISCUSSION

Chairman BIGGERT. Thank you very much.

We will now proceed to questions by the Members of the Subcommittee, and we try and limit ourselves to five minutes, also. So I will recognize myself for five minutes.

And my first question is for Mr. Magwood. Do you agree with the NERAC estimates on the level of investment needed to address the maintenance backlog and the equipment upgrades and replacement of outdated equipment to bring INL facilities up to the world-class level?

Mr. MAGWOOD. We have, as I mentioned in my statement, been in the process of creating a 10-year site plan, and a draft of which we have provided to the Subcommittee staff for their examination. I won't make a comparison between the estimates contained in the site plan and the estimates that NERAC made. I think there are some different bases there, but there is no question that there is a significant maintenance backlog, there is a significant disinvestment that the laboratory has faced over the last decade because it did not have a research focus in the past, which needs to be addressed. There is no question of that. And in particular, we are very concerned about the maintenance of the principal user facility on the site, which is the advanced test reactor. All of these things require a focused effort to deal with the backlog, and we intend to carry out that program to address that backlog.

Chairman BIGGERT. Well, how does the Department's request for proposal (RFP) for the INL treat the other labs? Does it involve transfer of people, equipment, or facilities or any research and development activities from the other labs to INL?

Mr. MAGWOOD. We don't anticipate the transfer of people or, for the most part, major programs from the other laboratories. The only transfer that we have reflected in the RFP is the consolidation of our Plutonium-238 activities at the Idaho laboratory. We feel that it makes a lot of sense to consolidate those activities, because they involve the transport of a potentially hazardous—well, a very hazardous material, Plutonium-238. And instead of transporting this material back and forth across the country, we want to focus the program in one place and leave it in one place until the final product is sent to NASA, which is the principle customer of national security users. Other than that, we expect that the programs at the other laboratories will continue as they are and continue to grow at a reasonable pace over time, because there are important expertise at the various laboratories, particularly the ones I mentioned, that we feel are absolutely essential to a successful nuclear energy program, and it makes no sense to replicate facilities or expertise in the Idaho laboratory that are currently available and doing well at other labs. So we intend to apply those capabilities.

Chairman BIGGERT. Well, since NERAC estimates that there needs to be an immediate investment of $90 million to get the INL mission ready and you are not going to transfer any, you know—anything from other labs, there certainly is going to be—has to be a lot of, you know, immediate equipment that can't be phased in and actually staffed. Scientists are going to have to be hired. And your timeline is what, the 10 years?

Mr. MAGWOOD. Well, let me clarify that. I—NERAC's conclusion, and I think Dr. Long could speak to this better than I can, but NERAC's recommendation was that there is a $90 million backlog. That doesn't mean that you have to do it all in one year. It can be done over some period of time, and we anticipate dealing with that backlog over a period of time and transferring research programs and personnel from the other laboratories would not assist us in addressing that backlog. What needs to happen is that we need to have a plan, which we now have, which the staff has been given access to, to focus to deal with the maintenance backlog and to eliminate the backlog. And we are going to do that.

Our plan, which is reflected in our request for proposals, is that between now—or between the inception of the laboratory early next year, in 10 years from there that the Idaho laboratory would have the people, the facilities, the equipment that would make it clearly the best nuclear energy research laboratory in the world, we hope. And we think that is a possible goal. And we think that the NGNP is not the only component of that, but it is a very important starting point to build that capability in the laboratory.

Chairman BIGGERT. Won't transferring the Pu-238 program to INL be more costly?

Mr. MAGWOOD. We think that it will actually pay for itself over time, because it is very expensive to transport Pu-238 and some of the precursor materials back and forth across the country in secure transports, especially as we deal with increased security requirements. And also, it makes a lot of sense for us to consolidate these activities and consolidate the expertise in one place. We think the efficiencies we gain from that will make the program pay for itself in about 10 or 15 years. We don't have a precise estimate at this point; we are still developing that. But if this goes forward, I think we will find that we have a much, much more efficient program, a more secure program, and really a better program.

Chairman BIGGERT. All right. Thank you. My time has expired.

I recognize the Ranking Member, Mr. Larson, for five minutes.

Mr. LARSON. Thank you. Thank you, Madame Chairman, and I thank the distinguished panelists for your comments.

I was struck by your testimony. It seems that there is unanimity in the need and concern for ongoing funding, that we are under-funded in many critical areas. I think, Dr. Waltar, you suggested about $300 million on an annual basis. I would suggest it probably will take more than that. I was also struck in the—your testimony, Dr. Waltar, about, excuse me, nuclear power. And I wanted you, if you could, to elaborate. I am a big proponent of moving from a petro-economy to a hydro-economy, and you seem to imply in your testimony that it was only realistic—or more feasible, shall I say, that it be nuclear power that aides and abets the movement towards—assists hydrogen power. You addressed, I think, vehicles in your comments or eluded to that. Could you amplify those comments and could you explain the relationship between the two, given that there is a great deal of skepticism often that exists in the public about nuclear energy? I am wondering if the linkage between the two could be a bridge towards a technological breakthrough.

Dr. WALTAR. Thank you, Mr. Larson. Excellent question.

Yeah, about $\frac{1}{3}$ of our total energy that we use in this country is in the form of petroleum and that is, I don't know what percent, 90 or 95 percent of our transportation. We know that we have peaked our oil production in this country and we are getting close to peaking now in the world. And so, at some point in time, you know, that resource is going to go away, and we know that the resource is in very unstable regions. We are very, very dependent on petroleum. So we need another energy carrier. And hydrogen appears to be that type of a system. As you know, it is hydrogen and oxygen combined and the waste product is water. That sounds really good. Now of course, those that are not in the business would say, "Well, there is lots of hydrogen in water." Yeah, but that is the ash. We have got to get the hydrogen out of the water and it takes energy to get it. Right now, hydrogen in this country is being produced for the petrochemical industry to boost the octane ratings and so forth, but it comes from hydrocarbons. And if we continue to get our hydrogen there, we are going to be dispersing more CO_2 and so forth. It is not—it certainly isn't compatible with long-term environmental stewardship.

So the question posed is that it takes energy to get the hydrogen out wherever we get it. And nuclear power looks like the kind of resource that, number one, has the sustainability to do it. I mean, we, presumably, would have nuclear power here for at least a millennium, if we choose to do that. We can do so from a very environmentally compatible standpoint, so it seems like the one energy source that has all of the attributes capable of producing enough energy to get enough hydrogen that we can actually displace petroleum for our transportation sector. In fact, in this six lab directors report that I think I attached to the written testimony, the goal was by the year 2050 to have about 50 percent of all of our electricity in this country produced from nuclear. Now it is about 20 percent. That is a huge increase, extremely ambitious. But also, maybe up to 25 percent of all of the petroleum, if you will, that is being used for transportation. Again, huge, huge challenge, but nuclear energy does have the capability——

Mr. LARSON. What kind of investment would it take, because when you talk to people, you get varying accounts? Now it seems to me once the country sets its mind on a vision, if we are able to place a man on the moon within 10 years, which I would suggest probably is more technologically difficult than being able to provide transmission or the heating and cooling of buildings with hydrogen, what is the stumbling block? Is it simply the amount of money? We are spending over—we are going to be over $200 billion in the current Iraqi war. It would seem to me if we had 1/10 of that devoted on an annual basis that we would be able to extricate ourselves, as all of you have suggested, from dependency. How much money? Is there a direct correlation between the amount of money, research and development, and the time frame it takes to, say, make us not energy independent but energy sufficient, even for that matter? The good Dr. Bartlett reminds us, of course, that we only have about two percent of the world's remaining reserves here, in this country, and there is about, I think, 66 percent, he reminds us, in the Gulf States where we find ourselves in a current quagmire.

Dr. WALTAR. I don't have a good feeling of the total amount of money. Maybe somebody else here can help. But clearly, we have to at least find out how best to get the hydrogen, and this can either be done chemically or through a reverse fuel cell kind of technique, and we need to exercise that capability. As Dr. Klein pointed out, nuclear engineers, as fabulous as we are, can't do it all. We need the chemical engineers. We need the entire scientific infrastructure. I am sure Mr. Ehlers would know. But good science is needed here, because we are talking about processes that are up to around 800 degrees Centigrade and so forth. There is a lot of work that has to be done. Substantially more effort is needed to be done. There is no question about it. But we also, then, have to develop high temperature designs if nuclear is to be the energy source. That is why the high-temperature gas reactor is so important, because we have to get temperatures much higher than our current fleet of 103 reactors that are operating now. We simply don't have high enough efficiencies to do it unless, as some would say, we could use electricity during the night and so forth, when it is cheap, if you will, to do this. So it is possible that we could transition this, but we do need sufficient funds to develop the best process to make the hydrogen and also to develop the reactor technology to get the temperatures we need to do it.

Maybe, Bill, you would like to talk about the amount of money required. I really don't have a good feel for that.

Mr. MAGWOOD. Well, Mr. Larson, I think that—I will say a couple things very quickly; I know your time is expiring. But it is not really just the money, because we—for example, the NGNP is a vital step in applying nuclear energy to the production of hydrogen. If we are successful in doing that. The early estimates, which were not performed by my office, but actually by our Office of Energy Efficiency and Renewable Energy, were that we could achieve the equivalent cost of hydrogen through these advanced reactors that would be equivalent to $1.50 to $2 for a gallon of gasoline, which, when the estimate was made, was about the same as gas, and which now would be a pretty good deal, especially for people like me with SUVs. So there is a—there is research that needs to be done. That research is simply going to take time. But I think that really, the more difficult issue is going to be the infrastructure, and transitioning over from today's infrastructure, which carries electricity in wires and natural gas in pipelines, to one where we find a way to move hydrogen around. It is going to be a major transition.

And then beyond that, on the use side, we have a lot of research——

Mr. LARSON. It sounds like a great WPA project for our nation in desperate need of putting people back to work.

Mr. MAGWOOD. Well, I will say one last comment, and that is that—and it is something that the Department is working very, very hard on under the President's National Hydrogen Fuel Initiative, which is that we really need to make the fuel cell technology as efficient as possible so that we can build these vehicles for the future. And I have actually gone around to high schools across the country talking about the link between hydrogen and nuclear. You should see their eyes light up when we talk about this. And they are excited, and we are excited. And we think this can be done, but it will take time, and it will take some resources.

Chairman BIGGERT. Thank you.

Next is Dr. Bartlett is recognized for five minutes, the gentleman from Maryland.

Mr. BARTLETT. Thank you very much.

There are, I gather, three different nuclear processes from which we could get energy: light water reactors and breeder reactors, and fusion. Which of these will you be exploring in your new laboratory?

Mr. MAGWOOD. I guess this is a question for me, Mr. Bartlett.

We actually—other than fusion, I think we will explore almost every nuclear technology. As I mentioned earlier on, the Generation IV International Forum identified six technologies of which I think two or three, actually, were liquid metal reactor, fast meter reactors. There were a couple thermal reactors, but you know, beyond even what you mentioned, there are also some other technologies, so there is a wide range of technologies. This laboratory will be active in all of those areas, but the principle near-term focus will actually be with gas-cooled reactor technology and development of the Next Generation Nuclear Plant.

Mr. BARTLETT. You will be exploring some technologies that do not depend on fissionable Uranium?

Mr. MAGWOOD. Well, I think that we will be looking at different fuel cycle options. There are, certainly, technologies that would use, for example, Thorium instead of Uranium. I don't think that that is a high priority for us right now, because we think there is a lot of Uranium available, and particularly——

Mr. BARTLETT. How much Uranium, do you think, is available?

Mr. MAGWOOD. Well, there are different estimates about that. There is actually a lot of argument in the technical community about it. As a matter of fact, Commerce tasked us in last year's appropriation to develop a better estimate, but estimates I have seen range from where Uranium would start to run out, maybe, in about a century. And there are others that think it would be available much longer than that. But I like to assume that the Uranium will be around for the near-term but that we need to have some better options for the longer-term.

Mr. BARTLETT. Well, that was the intent of my question. If we are looking for a replacement for fossil fuels, we need to look at something that will be here for longer than fossil fuels. Oil, as was mentioned, we have about 1,000 gigabarrels of known reserves in the world. We will find more. We would sure as heck like to use more, and so would China and India, by the way, that are using enormously more now. And if the more we find matches the more we would like to use, we are going to be more than lucky. We are not going to find that much more. If you divide the 80 million barrels a day we use into the 1,000 gigabarrels of known reserves, we have about 40 years of oil left in the world. And it is not going to last 40 years, because we would sure like to use more and we are not going to find enough more to match the more that we would like to use. So we have got to be looking at something that is going to carry us beyond this age of oil. And my understanding is that if it is simply fissionable Uranium, that there is not a heck of a lot more reserves of that in the world than there is of oil. So we have got to be looking at something beyond that.

And that brings you to breeder reactors, a whole new set of challenges. I am a big, big fan of nuclear. We have got to do something. And I think, Dr. Waltar, that we could do without either nuclear or fossil fuels if, in fact, we exploited all of the opportunities we have for conservation, for efficiency, and for renewables. There is enough wind, if you can stand all of the wind machines on all of the hills to produce all of the electricity that we need in this country. But I think the big challenge is in educating our people that we have got to do something. Going along the way we are now is not acceptable. We will come to a big crunch in the future. And the biggest impediment to more nuclear power is not our R&D and good ideas for better facilities; it is the—it is education. And the American—we have a culture which now will not support increased nuclear use. We have got to change that culture. How do we do that? Do we need some shock therapy somehow? How do we do it? And whose responsibility is that?

Dr. WALTAR. I will take a crack at that.

Mr. BARTLETT. Yes, sir.

Dr. WALTAR. I love this committee. You are asking all of the right questions.

First of all, you are absolutely right. We have to think in terms of energy resources, we have to have something beyond coal and so forth, and I think your discussion implies ultimately, if we use the breeder reactor, we can get there. We have a millennia sort of thing. You are pouring warm milk in front of a puppy dog here since I wrote the book on fast breeder reactors. There is another reason that technology needs to be pushed on, that is because of

Yucca Mountain. The question is how can we extend the utility there. And so I think one of the programs that Dr. Magwood talked about was, ultimately, a fast-spectrum reactor to transmute those things so we can go from tens of thousands of years to perhaps a few hundreds of years kind of thing and substantially reduce the waste.

On education, this is an incredibly important thing. Frankly, more Americans support nuclear energy than we are led to believe. Poll after poll after poll would indicate that more people themselves understand exactly what you said but they don't think their neighbor feels the same thing. You don't feel that Mr. Ehlers feels that way. He does. I can tell you that. But I think we have to understand something. We have to have some leadership. And when we look at the importance of what energy does to free our society, to allow us to live the way we do, and recognize that the rest of the world is looking at us and is green with envy and the frustration that causes. Energy is essential for security and for prosperity, we have to get there, so we have to look beyond what we have now. And with science and technology, there are a lot of levers that we can pull, but I frankly would go back to Members of Congress. Tell it like it is. We are viewed sometimes as biased to justify our own business, so to speak, but frankly, we have to have some courage. We have to ring the bell. And it just has to be done.

Mr. BARTLETT. Thank you very much.

Thank you, Madame Chair.

Chairman BIGGERT. The gentleman's time has expired.

The gentlewoman from California, Ms. Woolsey, is recognized for five minutes.

Ms. WOOLSEY. Thank you, Madame Chairwoman.

I would like to point out that when Roscoe Bartlett talks like he just did about the future, he drives a hybrid car. He means what he is saying.

Dr. Waltar, Dr. Long, any of you, whenever we speak of nuclear anything, I immediately get nervous about human error and about waste. So I am going to talk—I hope you will answer my waste questions for me. You know. Keeping humans from being human and making mistakes is one thing, but creating waste purposefully and not having anything to do with it—to do—any way to handle it is something else. So when we are talking about the Idaho lab and a 10-year window of dealing with the waste, I would like you to tell me, any of you that know, will it be finished in 10 years and what are we going to do with the new waste? And will there be the funds there if we are finished with cleaning up the waste 10 years later? You can—whoever you think is best to answer this or——

Dr. WALTAR. Let me take personal blame for that. Because when I went into this business 20 or 30 years ago, I could have gone into the science of treating nuclear waste, if you will. I didn't want to do it. Why? Because it was something we didn't have to deal with for decades. We reasoned that if the waste is so small than we can start later. I wanted to build reactors. I wanted to do exciting things. I think I can speak for my generation. We did that. Now scientists are not very good politicians. 20 or 30 years ago, there was a lot of support for nuclear energy. We could have built our waste repositories. It would have gone through easily, but we didn't do it, because we didn't have to, because, in fact, the waste is so small. Now, unfortunately, it has been turned around, and somehow the public is of the opinion that this is something that can't be dealt with. The reality is the waste quantity is so small that there are lots of creative engineers that can think of ways to deal with that. And so it sounds like it is not solvable, but, as I have indicated earlier, we have ways. We, in fact, can store everything from our current nuclear reactors now in Yucca Mountain as is currently, but it is not enough. I mean, we are going to have to ultimately, perhaps, have more. But I mentioned earlier in my question to Mr. Bartlett, there are ways to convert this waste from a long-term concern of, you know, tens of thousands of years into a few hundred years.

I should say also that something that has a very long half-life of several thousands of years sounds dangerous. The fact is that is far less dangerous than something that has a short half-life. I mean, arsenic and lead and these things have infinite half-lives. So I think there is a question of how to convey the fact that nuclear waste, yeah, it is not something we want to put in our pocket, but there are scientific ways to deal with this. So from a technical standpoint, it is not an issue. It really, quite honestly, is a political one.

Ms. WOOLSEY. Well, okay, let us—Yucca Mountain is not a sure thing. And it is being challenged every which way. And no matter how small it is, doesn't it have to go some place? What is it going to cost? Who is going to pay for it? And is it going to happen?

Dr. LONG. I—Ms. Woolsey, I think it is certainly important that you understand that the utility industry has been collecting 1/10 of a mil per kilowatt hour from the beginning of the generation of nuclear power and that there is now about $17 billion in that fund that has accumulated to provide for the disposal of the waste. So the money is there. The Congress has had difficulty allocating it so that the progress on Yucca Mountain could move forward. I am a past President of the American Nuclear Society as well as Alan, and in 1991, I gave a speech at a Russian conference about the history of our dealing with nuclear waste, and they said they didn't believe it. We couldn't be so messed. We had just not done the things that we needed to do. We haven't done the things that the Congress has directed us to do. We let it slip. But as Alan said, the volumes of waste are very small, and the storage of the fuel at the site is the way that the industry now takes care of the high-level activity in the spent fuel.

Ms. WOOLSEY. Is there no other way to—a more scientific way to deal with waste than Yucca Mountain? Obviously not, or you would have said yes right away.

Dr. LONG. Well, Alan has mentioned that you can transmute the waste. You put the spent—the fission products and the trans-Uranium products into a fast reactor. You can convert some of them to much less harmful isotopes. So there are ways, and that is part of the Advanced Fuel Concepts Initiative that the Office of Nuclear Energy is directing.

Ms. WOOLSEY. All right. Thank you. My time is up.

Chairman BIGGERT. Thank you very much.

I recognize another doctor, Dr. Ehlers, the gentleman from Michigan, for five minutes.

Mr. EHLERS. Actually, I could use 20 minutes, but I will try to do what I can.

First of all, just a comment on the issues that were just mentioned, which are largely political. Many years ago, I did a fairly—took a fairly good look at the environmental dangers and aspects of power generation of various types, and I came to the conclusion that coal-fired plants and perhaps gasillary plants and nuclear power are all equally bad, and that is simply because they each have very difficult environmental problems. And obviously fossil fuel is a difficult problem because of the greenhouse gases and the effect that it could have on climate change. The nuclear industry, of course, has the problem of dealing with waste and potential disasters. Frankly, I would much rather deal with a few hundred cubic yards of nuclear waste than to try to contain the greenhouse gases from fossil fuel plants. And yet the public chose the other option. And I have had a—I have been a member of the Sierra Club for over 30 years, and I have had many arguments with my fellow members on that topic. I just think they have pushed an alternative that is really not that good. The best alternatives are doing other things. Hydrogen, of course, if we can produce it in a non-polluting way, would be good, and that is why this particular project is so extremely important because if we don't do it this way, we are going to do it from fossil fuels, which just compounds the problem we already have.

Now on the proposal itself of what this hearing is about, I—it probably makes sense to consolidate things. I am not yet convinced it is—consolidating in Idaho is the best thing. I just don't know, at this moment, where the most expertise resides and the best facilities, but I am certainly willing to consider that. At the same time, it sounds to me like kind of a half-baked proposal. Maybe I just don't know enough of the details, but when you come out with a proposal to consolidate and reduce the funding by $6 million, that means you are not serious about the project, because if you really want to combine this and really want to achieve the goal of developing this new type of reactor and including looking at hydrogen production, you are talking big money. And so there better be big money behind this proposal, otherwise it is really meaningless, and I am not sure it is worth going forward with.

We have got a lot of infrastructure to develop, too. We have allowed nuclear engineering education programs to wither on the vine, so we don't have as many experts out there as we need if we are serious about going in this direction.

A question I have is where is the rest of the world on this? Are we just going to be playing catch up or are we better off just using the knowledge that they have developed, because they have continued their work on this? And why—what is our advantage of going ahead with our own efforts? Are we going to be duplicating it or are we trying to do something so new and different that it is worth the investment, a very large investment, that we have to make in this? So that is my first question.

Mr. MAGWOOD. Well, let me try to answer that.

First, let me thank you for that comment. I agree with many things you say. I hope to convince you, over time, that our plan for the Idaho laboratory is the right approach to build a central command center, as Secretary Abraham has put it, for nuclear engineering research. And I do believe that the expertise that is available in Idaho gives us an excellent starting point in creating such a laboratory. We are going to work with the laboratory, the Idaho National Laboratory, to coordinate very closely with our international partners. As I mentioned, we have formed an organization of governments called the Generation IV International Forum, which now has ten members, that is very closely coordinating research in most of the key areas associated with new technologies in nuclear engineering research. And these countries are going to implement research and development plans together. For example, in the case of the NGNP and the very high-temperature reactor technology that it is based on, we, the Japanese, the French, the Koreans, and the South Africans, actually, have already begun work on a joint research plan to advance that area of technology. And in doing so, we will be able to avoid duplicating the effort that the others have accomplished. The Japanese, in particular, have recently achieved remarkable success in one of their facilities in reaching a temperature of 950 Centigrade, which is getting very close to the level that we are aiming for in our reactor design, and also have produced hydrogen in a limited quantity. So they have made an investment over the '90s that we hope to benefit from. And we think that when we look at what they have accomplished and what the French have accomplished and what some of these other countries have accomplished, working with our Idaho laboratory and doing new research in key areas, we will be in—successful in pulling this together and having—if the decision goes forward to actually proceed with this, having a facility that is actually making electricity, making hydrogen some time in the middle of the next decade. So we think this is very possible, and we are off to a good start, I believe.

Mr. EHLERS. Okay. Let me just make one last comment, since my time has expired, on the political nature that Dr. Waltar observed. And you are right, scientists tend not to be good politicians, with the exception of the two sitting right here, but the industry has done a terrible job, and I said this many years ago, and then it kept running these ads saying, "Nuclear power is safe. We have made it safe. Nothing can happen," which is a stupid thing to do, because things do happen. So when Three Mile Island happened, everyone—they lost all credibility. If they had simply said, "We have made them safe so that when accidents happen, it won't hurt you. We may lose $2 billion, but it won't hurt the public," then Three Mile Island would have verified—exploited what they said, and it would have been a totally different issue. Promising total safety is an absurd thing to do and you can't do it.

Thank you.

Chairman BIGGERT. Thank you, Dr. Ehlers.

Dr. Gingrey from Georgia, the gentleman from Georgia is recognized for five minutes.

Mr. GINGREY. Thank you, Chairman Biggert.

Dr. Long, in Dr. Klein's testimony, he said that the Next Generation Nuclear Plant could be designed to be a multidisciplinary research tool rather than as simply a demonstration project. But you suggest in your testimony that the Next Generation Nuclear Plant should not be seen as a user facility for researchers. Can you explain your disagreement on this—or seemed disagreement on this point?

Dr. LONG. Yes, sir. It is—I think the NGNP research that is needed can be a center of excellence kind of exploration, and I believe that is what Dr. Klein was referring to. My specific comment was that once it is completed and is now in the production mode that it would not then be seen, I don't believe, as a user facility. So that is the difference that—the research—as Mr. Magwood has pointed out, there is a number of quite extensive research efforts, high-temperature materials and the transport of hydrogen, lots of things that need to be done that could be—to form a center of excellence, which could be very attractive. Once the facility is completed, however, it will become a production facility, and I spent 20 years of my career in the power industry. And people who are in production mode don't do much research.

Mr. GINGREY. Dr. Klein, your comment?

Dr. KLEIN. Since Dr. Long are in this Committee, we haven't gotten very far. That is an open question for discussion, but I would agree with what he just said. When we start operation of the NGNP, it likely will be just a production facility and that. But I think it can be designed so that while we are getting there, and even while it is being operated, maybe we can get some continued research out of it. The completion between research and production will be severe, and often research will lose out.

Mr. GINGREY. Well, that is a segue into my next question, and I will direct this to Dr. Long, you, and also Dr. Waltar. What new facilities are needed to carry out the Department of Energy's nuclear energy R&D missions? Should all of these new facilities be built at the Idaho National Laboratory?

Dr. LONG. I will answer the first part—the second part first, no; it will not all be done, and I think Mr. Magwood has pointed that out. We set—I—from when I did my piece—dissertation at Argonne, I worked as a student at Oak Ridge, so I am familiar with other laboratories and capabilities there. So the role of Idaho, I see, is one of coordinating, facilitating, guiding the whole process and identifying. One facility that is clear, to me at least, will be a source of fast neutrons. And we have shut down the reactors that can produce fast neutrons for fuel development. So where that should be developed, I think, is a question that will have to be answered over time, but is certainly one of the ones that will be needed. And then extensive high-temperature materials research will be needed. And I think that will fall into the various laboratories, not just at Idaho.

Mr. GINGREY. Dr. Waltar.

Dr. WALTAR. Well, I tend to agree with that. But I think it is awfully important that we make the commitment on this new reactor at Idaho for several reasons, to galvanize our commitment toward high-temperature for the possibility of hydrogen production. That is very, very important, as comments were made earlier. Secondly, we have to recognize, and several people have recorded this, we need the best and brightest in this field. This is not rocket science. It is better than that. And a lot depends on success, as Dr. Ehlers has said. I mean, we can't make gross mistakes here. So it is very important that we attract the best and brightest students in the Nation to come into this business. And what attracts them more than anything else is a program that is moving, something real, something that they can identify with. And I believe that this new reactor that we are talking about is the right first step. As Dr. Long pointed out, we will need other facilities, and we will need side facilities with other national laboratories to support this, but that focus has enormous appeal to the next generation, and we simply have to get them into this business.

Mr. GINGREY. Thank you.

Thank you, Madame Chairman. I yield back.

Chairman BIGGERT. Thank you, Dr. Gingrey.

We will start another round, then, and I will recognize myself for five minutes.

All right. Dr. Klein, in your written testimony, you site the Jet Propulsion Laboratory in California as an example to follow. You said that JPL specializes in deep space probes but also supports a wide spectrum of research. How should INL emulate JPL's example? And should INL's R&D portfolio be as broad as that of the other DOE multipurpose labs?

Dr. KLEIN. JPL is one of the routes we took already in the process that we are going through. We learned quite a bit about them. There are some things that can be replicated in Idaho. There are many things that can not. It is going to be a challenge of the new maintenance operations contractor to do that. For example, there is no Cal Tech in Idaho Falls. It is a reality. So they are going to have to come up with ways to work with regional, local, and national universities to bring in that talent that the Cal Tech, being right next door, does. The new technologies will allow that. We can find ways to bring people there from anywhere from an hour to full-time. It doesn't have to just be sitting onsite in Idaho Falls to do this. It is going to take a challenge.

Chairman BIGGERT. I know that Idaho is a—is not a large state, but it has got a lot of wide open spaces, and it doesn't have the metropolitan area that I know a lot of the labs have to have in the universities there, and so we—are we really going to then have to develop at that site or nearby the universities of the caliber of Cal Tech if we are going to have this to be a leading lab?

Dr. KLEIN. I think that would be a very—that part of it would be a challenge, but it doesn't mean it couldn't use the distance education technology, the high-tech technologies we have developed. Communication skills now are much better than they were when we set up JPL in 1950. So I think good as much—in fact, JPL grew out of Cal Tech. I think that this is a different picture. I think it is going to be a challenge to do it, but I think the capabilities are there to get the people that need to be involved in these programs, whether they are in Chicago, at Argonne, whether they are at Oak Ridge, whether they are at Brooke Haven, Los Alamos, any of the other labs, and particularly, the universities across the country.

Chairman BIGGERT. That leads to another question for—maybe for you or for Dr. Waltar that Argonne National Lab has considerable expertise in computing and simulation that could be used to model an advanced reactor design. Should we begin with a collaboration between INL and Argonne to simulate the proposed designs for the NGNP or why wouldn't we take advantage of the improvements in high-performance computing to refine the reactor at the time before investing $1 billion?

Dr. KLEIN. I would like to see a collaboration be very strong between the two groups. I think that it is absolutely necessary to have that collaboration. Where you put the computers that do that doesn't really matter these days anymore. I think that really—they can be put anywhere, pretty much. But I think the collaboration is going to be very important to get down to the basic principles of science to get those down as far and get rid of correlations, simple things like that in these models. I mean, new model development is going to be critical.

Dr. WALTAR. Maybe I could just add to that. I spent a lot of my career at Argonne National Laboratory East. I have enormous respect for the capability. And you are absolutely right, a lot of the early models and more, very sophisticated modeling would be done there. But you know, as Andy pointed out, I think we are hearing that we can collaborate, we must collaborate. The reality is a lot of the professionals at the laboratories simply don't want to move. It wouldn't matter whether they were asked to move to Idaho or moving to somewhere else. Their families are there. They have grown up there, and they like it. So we have to find a way to take advantage of those professionals, and frankly, if there is major science going on, it will happen. The collaboration will take place. I think we can say, you know, the networking is powerful. This is not a huge business. It is not like many other industries. Most people know each other. And as long as we have got a good, aggressive program with strong leadership, people can work together. They really, truly can.

Chairman BIGGERT. Well, I think you are absolutely right, too. We are going to have to have more nuclear scientists and engineers, because so many are, you know—I think within five years, 75 percent will be eligible for retirement. And if we don't bring the young people——

Dr. WALTAR. I have jet black hair. I just paint it gray!

Chairman BIGGERT. Thank you. And then Dr.—or Mr. Magwood, the NERAC Infrastructure Task Force had, I think, urged the Department not to link the INL funding to future decreases in funding for the Idaho cleanup project. And I am bringing this back to basic questions, so I make sure we—I think we have had a really good talk over. This is kind of a—but just what is the Department's response to that recommendation?

Mr. MAGWOOD. Well, I think what I can say about that is we really have seen the impossible decreases in funding for the environmental management program in Idaho as an opportunity. I think that as EM program is successful in accomplishing its missions, it will free up the budget targets, which are increasingly dearer these days, that can be applied in Idaho to the research mission. I don't—I see that as an opportunity. I don't see that as a limitation. I think that what we are planning right now for the NGNP is not predicated on the EM program. I think it is really—I think—but I do hope that that does occur, because as EM completes its mission, not only frees up resources, it really gets out of the way, and once it——

Chairman BIGGERT. I guess the problem is that it is not going to be immediate, and we have been talking about how important this is and—you know, to develop the nuclear to take the place of the fossil fuels, so it seems to me, then, that we are just delaying this.

Mr. MAGWOOD. But again, I don't think that we are waiting for EM to go down before we go up. We really are looking right now at what is necessary to go forward with what we have talked about. And I am not linking that, at this point, to——

Chairman BIGGERT. But we have had a decrease in funds, and that is—I think, as Dr. Bartlett said, do we really have a commitment to do this then, not only doing this plus the decrease in funding?

Mr. MAGWOOD. Right. I think the Department has a commitment. I have worked very closely with the senior management department. They take the development of the laboratory, they take the NGNP and the Advanced Fuel Cycle Initiative, and other programs very, very seriously. I do think that the fiscal year 2005 request did reflect, you know, a lot of tightness in the budget that we had to deal with last year for a lot of reasons that I think you are very familiar with and also reflected the state of some of the programs where we had to make some tough choices. And I think it was reflected in the request. But I also recognize that—you know, that we are—we do have to balance—or we have to live within the constraints, and we have to fight for our programs and other programs fight for their programs. And I think you will see the nuclear energy program do quite well as things go forward in the future. I actually feel like we are getting off to a good start, because—mostly because I think we have such a strong planning basis. And I think the word that the people here at this table have—including Dr. Waltar, while he isn't a member of NERAC, has served on the Advisory Task Force for us, and I think that we have one of the strongest playing bases of any technical program in the Department. And I feel very confident that that will prove to be very beneficial as we are fighting for funding in the future.

Chairman BIGGERT. Thank you.

The gentleman from California is recognized.

Ms. WOOLSEY. Thank you, Madame Chairwoman.

Dr. Klein, every one of our facilities has stockpiles of nuclear waste and materials. And there is the concern, of course, about security. So how are we doing inside the facilities and Homeland Security? Are we addressing this, the stockpiles of nuclear waste? And what else do we need to do?

Dr. KLEIN. Most definitely. The—there have been significant increases in the last 2½ years in the amount of security and the activities on the sites of, I am sure, all of our facilities, including our little one in Oregon. We take very seriously our role of protecting that material. Going for it, I know the nuclear utilities around their plants have spent a large amount of money. I have talked to the utility executives. They are concerned about the amounts of having to spend, but they are spending a lot of money and putting the emphasis on protecting those materials.

Ms. WOOLSEY. Okay. Well, it is one thing to be spending money and another thing to be successful. So now is there anything we are not doing that Homeland Security should be addressing? I mean, we are in the middle of this right now, and to overlook it would be a big mistake.

Dr. KLEIN. I don't feel confident to answer that question more than for my local facility.

Ms. WOOLSEY. All right.

Dr. KLEIN. I think we are doing the best at our facility.

Ms. WOOLSEY. All right. Dr. Long.

Dr. LONG. Yes. I am on the Environmental Safety Health Panel for the University of California who has oversight over Lawrence Berkley, Lawrence Livermore, and Los Alamos. I have been on the Los Alamos review panels for about eight years now and the other two for the last two years, and there has been significant reductions in the waste—the legacy waste, particularly, that have been left over from years of the bomb development in the original—from the '40s and the '50s and then with the Cold War. It is very impressive when you see the actual numbers, and I can't quote them to you, but there has been very, very significant reductions in the waste. Sandia laboratories and their nuclear facilities just interviewed some people a few weeks ago where they were describing literally tons of material that has been taken out of their facilities for proper storage.

Ms. WOOLSEY. Well, is this in response to 9/11 and the fear of terrorism? I mean, this is what I am getting at with Homeland Security and how vulnerable you all are.

Dr. LONG. Some of it is in response to that, but I think in terms of the reduction of the legacy waste, that has been a long-term policy of DOE that they have worked at consistently for a number of years. In the security area, there are certainly major efforts in all of those laboratories that I am closely associated with to identify potential problems to correct them, to increase the security levels where needed. So I am convinced that people are very sensitive to potential threats of terrorism and addressing them.

Ms. WOOLSEY. Well, is there anything the Federal Government should be doing? Dr. Waltar.

Dr. WALTAR. Yes, to add, I think to what has been said, I don't disagree personally. I have very little experience directly in the security area, but again, everything that I have heard said here is consistent. I know I have talked to some utility executives as well, and the laboratory people. You know. They are in the spotlight, they recognize. We live this side of 9/11. I couldn't say that there isn't something additional we could do, but, you know, at some point in time, the returns are—I am just not really qualified to——

Ms. WOOLSEY. Mr. Magwood.

Mr. MAGWOOD. Well, I think we clearly have taken the steps that we can take at this time. We have really focused a lot on our security infrastructure. We have, I think, improved things significantly since 9/11. I don't think there is any question of that. The Department has taken on the practice of consolidating the location of nuclear materials. For example, the decision was very tough for us, we have moved from a site in Ohio where we were storing Plutonium-238 and doing work there, and it was a very good site for us, and moved it to Idaho, because we felt it was safer in Idaho than it was at this site in Ohio. And more of that sort of thing will take place. Secretary Abraham is very serious about this. I don't think there is any issue that he takes more seriously than the security of our infrastructure. And he has watched the—a look in exploration, the possibility in enhancing our guard forces, possibly even federalizing the guard forces to make sure we have the highest quality of protection. And I tell you, I have visited, just recently, one of our sites and found that the guard forces there were kind of scary, quite frankly. So I wouldn't advise anyone to take a run at any of our facilities. I think they will find that they will be challenged quite severely.

Ms. WOOLSEY. Thank you.

Chairman BIGGERT. Thank you very much.

The gentleman from Maryland, Dr. Bartlett.

Mr. BARTLETT. Thank you.

When was the last time we licensed a new nuclear power plant?

Dr. LONG. The last one was in 1991.

Mr. BARTLETT. This industry, since we are not building new plants and many of them are coming up to their age limit, they probably don't—they probably see themselves as a somewhat threatened industry, and I would understand their reluctance to be involved in cost share. How much of the nuclear energy R&D is industry cost share?

Mr. MAGWOOD. I guess I should answer that. It—there isn't a program. I think that if you look at, for example, the programs we have like Nuclear Power 2010, which are more focused on near-term deployment of nuclear plants, it is a 50/50 cost share. We expect the industry to put up as much as we put up. For some of the very long-term technology, such as the use of advanced nuclear technology to produce hydrogen, we are not really expecting a very large industry cost share with that, because it is really beyond where industry's mind is at this point. For the Next Generation Nuclear Plant program, we are hoping to see a cost share, not just with the industry, but with the international community, over the life of the project. We are hoping to get 50/50, but we are—we will see how that pans out. But you know, we think that cost sharing is important, not just because it saves the government money. I think that is the last reason to do it. I think it is important because it shows what industry, in the industry's judgment and the private sector's judgment, which I think, in these things, is better than our judgment, quite frankly, and what they think really is relevant and important to the future. And I think cost sharing gives you that guidance.

Mr. BARTLETT. So the appropriate cost share is determined by the specific project and how quickly that could be commercialized and how much benefit industry sees that they would get from that.

Let me ask you a generic question that I think a great many of our citizens are asking about our nuclear waste. We have a nuclear waste, which is so hot that we have to squirrel it away for maybe a quarter of a million years. I think a lot of people are having a problem understanding why something that has that much energy in it can't be good for something. Can you help explain why this stuff, which is so hot, we have to put somewhere out of sight for a quarter of a million years, isn't it good for something?

Dr. WALTAR. Let me take a quick crack at that. Yes, it is good for something. Frankly, to take our spent nuclear fuel and throw it in the ground, to me, is an atrocity. For one thing, the original high heat comes principally from Strontium-90 and Thesium-137, fission gases. Frankly, Thesium-137 is a good gamma emitter. It probably could be used for cleaning up municipal sewage areas. I chaired a Gordon Research Conference a few years ago. This—I don't know if many people are familiar with that. It is where scientists—the best scientists in the world get together and discuss what they want to and nothing leaks out of that because for fear that their funding could be cut or something like that. Now I had the audacity to suggest that perhaps we should be looking at what we now called waste as a resource. If we could look ahead, cubby-style, begin with the end in mind, the Strontium-90 could be used for power sources to power underground cables from New York to London or Paris rather than using copper wires until we are to re-energize these cables and so forth. There is a lot of potential if we think of it in terms of possibly using this as a resource rather than waste. Strontium-90, again, when the daughter product is Itrium-90, a good beta emitter that is now being used for many medical purposes. In fact, a study that was done in 1995 indicated that nuclear technology as such far more was going into nuclear medicine, agriculture, industry and so forth than in nuclear power. I mean, something like $330 billion a year. Only $90 billion in nuclear energy. So a lot of these byproducts, if we are smart enough to use those, and clearly, the fuel that—if we throw the stuff in the ground that still has Plutonium in it, that, of course, can be cycled back to your earlier question, it can be used in the breeder reactor and so forth. We can extract enormous amounts of energy. So I think we have to rise above the rhetoric, if you will, and recognize, yes, rather than being a waste, this, in fact, could be a tremendous resource. We have stuff concentrated that potentially can be used. Now that is not to suggest that we trivialize this. I don't, in any sense, suggest that. You know, we have got to protect it, but frankly, I think we need to start thinking about this in a way of how can we use this resource rather than throwing it away.

Mr. BARTLETT. I would suggest that an aggressive program to do just that would go a long way to convince the American public that this is something we ought to be doing. We have far too much waste across our whole country that could become a resource, and we just live with the old view that it is, you know, a waste. And there is almost nothing that should be a waste. Almost everything is good for something, and there is a challenge to figure out what it is good for. And I am not sure that we are aggressively addressing that challenge in our nuclear waste.

Thank you very much.

Chairman BIGGERT. If the gentleman would yield for just a moment, Argonne lab, we have been working on—they have been working on this issue for a long time with the EMT. I know Mr. Magwood and I have discussed this many times. And then it went to the spent fuel and transmutation, I can't even say the name, and then now it is the Advanced Fuel Cycle Initiative. And so, this is to negate these for their storage, because it would reduce the spent fuel so that it—right now, Yucca Mountain is—all of this waste was put into the Yucca Mountain that we now have. It would fill it up, and this reduces not only the amount that would go in there, but also the number of years down to 300 years, I believe it is. So I think there really is this going on, and I don't think that too many people know about it.

Dr. Ehlers is recognized for five minutes.

Mr. EHLERS. Thank you.

I just wanted to add that when you, Madame Chair, you asked the question about people coming to the national lab, and I have to express some reservations about that. It is kind of a remote location, and most of the national labs, which have lots of users flying in and out, are located near transportation facilities and so forth. I think, Mr. Magwood, you should be very concerned about that. Perhaps build a small airport on site if you are serious about getting people in and out on a regular basis.

I just—a couple questions. First of all, this Next Generation Nuclear Plant, is there a cost estimate on that, Mr. Magwood?

Mr. MAGWOOD. Very preliminary cost estimates. It is—it clearly will be probably between $1½ billion and $2 billion, if—when you include all of the research and everything that goes into it, but that is a very, very preliminary estimate.

Mr. EHLERS. Okay. And that is about the ballpark I would have guessed. So it is a huge facility. It is not clear to me from some of the comments made here whether this is intended to be primarily a research facility or a production facility. I have heard different answers from the panel. What is your plan?

Mr. MAGWOOD. Well, I can certainly tell you what our plan is. We see the NGNP as a pilot facility that we would like to see a Nuclear Regulatory Commission certification granted to, so that the next—so that we would not just simply be an experimental facility that a commercial utility could then, if this proves successful in the future, could replicate or nearly replicate the facility, with some modifications, obviously, because of the experimental nature of this, and then go to the commercial mode. We think that that is the target that makes sense for this, because we are not anticipating that this will be something that will be used for testing materials or testing fuels as much as it is to prove the concept is commercially viable, because we think that that is what is needed to drive the recovering nuclear energy in the longer-term future, giving it a technology that can make electricity and make hydrogen in a cost-effective way.

Mr. EHLERS. Now I have heard over and over that the biggest problem in the nuclear industry is that every new plant is an experiment and that what we need is a standardized product that people can put up with assurance that it is going to work and not do a lot of research on every new building. Are you envisioning that this would be—you say it is a pilot? Would you envision this would be a model that other people would replicate?

Mr. MAGWOOD. That is certainly—that is the plan. The plan is that we would achieve a design, achieve a plant that could be replicated, not just in the United States, but internationally, because one of the philosophies in the Generation IV International Forum is that for nuclear to be competitive in the future, the market for a particular nuclear plant has to be as large as possible. And if you simply make a few plants here, make a few plants there, you are never cost-effective. You really have to be in the position of having an ongoing production to make it cost-effective, and we think that that is what this can do, and many of international partners seem to think this is very possible.

Mr. EHLERS. And then you would really have to use the KISS principle, Keep It Simple, Stupid, so that it is easily replicated at a relatively low cost.

The—another question. Are you also, in your labs, investigating the production of hydrogen using other high-temperature means? Now let me explain the reason for that. It—hydrogen is not that easy to transport. It might make more sense to produce a lot of electricity and transport the electricity and then, in metropolitan areas, use that electricity in a high-temperature facility to produce the hydrogen. Are you investigating these possibilities as well rather than just making the hydrogen at the nuclear facility?

Mr. MAGWOOD. We are really running a very, very broad program in the Department. The Secretary issued, I think it is almost two years ago, a hydrogen posture plan that basically states that all of the elements of the Department involved in energy, our office, the Fossil Energy Office, Energy Efficiency, and Science, are all looking at different ways of producing and transporting hydrogen. And we are not making a judgment as to whether nuclear is the best way or biological sources are the best way to make hydrogen or even, you know, coal-based technologies are the best way. We are going to basically continue down all of these research paths, and we think that ultimately it will become clearer as we go on which way is appropriate. In my office, we are looking principally— we are looking at the broad range of technologies that can apply high temperatures, but we are focused on two right now. One is thermochemical, as you have mentioned, which is a very tricky technology at this point. We haven't solved all of those—all of the questions yet. But we are also looking at thermal-assisted electrolysis, which is probably something that could rely more on remote generation of electricity. But we are looking at those. But at this point, we are expecting that there would be a central generation of hydrogen, but we will see what the future holds.

Mr. EHLERS. Well, my point of this is simply that the premise of constructing this may not be a good premise. This may be a very expensive way to go, if you are designing this to produce hydrogen when there are other better and cheaper ways of doing it. And so you are talking $1 billion to $1½ billion on a project where you are not sure that that is the best way to proceed.

Mr. MAGWOOD. Well, that is why we are very focused on not simply having a hydrogen-producing facility but one that can do hydrogen or—and/or electricity, because this technology, because of the high temperatures, is also a very, very efficient way of making electricity. So then if it turns out that hydrogen is better done by using biological means or some other means, we still have the electricity. We are going to need electricity for a long, long time, and we think that this technology, even if we don't go forward with hydrogen, will be a very, very competitive way to make electricity, not just because of the efficiency of the technology, but also because of the smaller size of the reactors. We think that, in the long-term future, smaller systems, and these systems are probably about 250-megawatts electric from what we are looking at right now, provide for a better economic model for the industry. And we have heard this from many people in the utilities that being able to add smaller modules over time instead of one large plant that costs $2 billion would be a much more effective way to proceed. So we are looking at that as a possible future.

Mr. EHLERS. So you are talking about a 250-megawatt plant for $1 billion to $1½ billion?

Mr. MAGWOOD. Well, that is—when I talk about the $1 billion to $1½ billion, I am talking about the whole development costs, not just the construction.

Mr. EHLERS. Yeah. Okay. Okay. And I would point out you said and/or. There is a huge difference. If you put the and in there, you are probably adding another $200 million if you are going to try to do both the gas—the hydrogen production and the electricity production.

Mr. MAGWOOD. Well, our hydrogen—we have a set—we have—what we have done is we have a base program to develop the NGNP technology, but that doesn't include the hydrogen development. The hydrogen development is an entirely separate program called Nuclear Hydrogen Initiative. And if we are successful on both accounts, we will marry the two technologies somewhere down the road and link the NGNP with the nuclear hydrogen production system. And if nuclear hydrogen proves not to be successful, that could go away. We could simply focus on electricity production.

Mr. EHLERS. All I would say is good luck. You have got an immense project here, and it is going to take an incredible amount of careful planning to get it done at a reasonable cost and a reasonably assured result.

Let me, if I may, just in conclusion, join in saying that I think when the Carter Administration some years ago decided against reprocessing waste, that was a political decision. That was not a scientific decision. And unfortunately, we—the attitude still is that that was the correct decision. I don't think it was. I think we could handle the waste much more efficiently and much more safely if we reprocessed it. But unfortunately, the efforts of reprocessing have resulted in considerable environmental contamination because of wrong procedures, sloppy approaches, improper oversight, and that has also created a problem. And we are still trying to clean up from all of those activities. But I really think I agree with Dr. Bartlett on that. That really should be the way to go and separate out what we can use and then deal properly with the remainder, whether we transmute it into something that is safer or do something else. I think we can do a lot better than we are doing, especially when it takes 20 years to dig a hole in the ground.

Chairman BIGGERT. Thank you, Dr. Ehlers.

And before we bring this hearing to a close, I want to thank our experts, our panelists, for testifying before this subcommittee today. And if there is no objection, the record will remain open for additional statements from Members and for answers to any follow-up questions the Subcommittee may ask of the panelists. Without objection, so ordered.

And the hearing is now adjourned. Thank you.

[Whereupon, at 11:47 a.m., the Subcommittee was adjourned.]

Appendix:

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by William D. Magwood, IV, Director of the Office of Nuclear Energy, Science, and Technology, The Department of Energy

Q1. The Department has indicated that it will select a contractor for operations and maintenance of the Idaho National Laboratory (INTL) in early November 2004. The Nuclear Energy Research Advisory Committee (NERAC) subcommittee charged with recommending measures to establish the laboratory as a world class facility is not expected to finalize its report until October 2004. Given this timeline, how will the Department incorporate the recommendations of the NERAC subcommittee into the provisions of the INL contract?

A1. The 1NL contract is a 10-year, performance-based contract. Throughout the life of the contract, the Department will develop performance measures to keep the contract focused on the goal of establishing the laboratory as a world-class research center within 10 years. The NERAC report will provide essential guidance to the Department as it develops the performance measures to achieve this goal.

Q2. After its research mission is completed, will the Next Generation Nuclear Plant (NGNP) be dedicated to commercial electricity production? If so, how has the expectation of commercial operation of the NGNP affected the cost-sharing provisions of the project?

A2. DOE's goal for cost share over the life of the project is 50 percent DOE funding and 50 percent industry contribution. As part of the project, the NGNP would be operated by its commercial owner(s) for as long as necessary to demonstrate the principles of its design, its operating reliability, and to prove the value of the technology to the marketplace. This demonstration period is thought to be five or more years. Once the project is complete, it is possible that the commercial owner(s) may elect to retain the plant and operate it for profit. We expect the agreement between DOE and the commercial owner(s) would contain an adjustment mechanism to take into account the additional value to the commercial owner(s) resulting from a decision to operate the plant for profit.

Q3. What specific provisions in the operations and maintenance (O&M) contract for the Idaho National Laboratory will require research collaborations with other national laboratories involved in nuclear energy R&D? To what extent will the selection of the O&M contractor be based on the inclusion of a well formulated plan for collaborations with nuclear energy R&D resources at other national laboratories?

A3. The Department believes that to provide effective leadership for the U.S. nuclear energy technology research endeavor, the INL must not only conduct successful research in Idaho, but must effectively coordinate and collaborate with other DOE national laboratories. While we plan to establish the INL as the U.S. "command center" for nuclear energy research, it is critical that we take full advantage of the important nuclear energy technology capabilities and expertise at other laboratories. The request for proposal (RFP) reflects this. As a principle example, the RFP requires all bidders to provide a clear plan for collaboration with nuclear energy R&D resources at other national laboratories. This plan will be an important element in the evaluation and selection process.

Section M of the RFP includes the criteria for evaluation of proposals and the selection of the new contractor. The Technical and Business Management Plan (M.4 (a)—Criterion 4 of the Capabilities and Approach Proposal) states that the Government will evaluate the offeror's approach and innovation in creating a multi-program laboratory with world class capabilities through international, industrial and academic collaboration.

Additionally, the mission performance requirements in Criterion 4(c) of Section M includes references to collaborations with other national laboratories, programs within the DOE, other federal agencies, universities, international partners and the private sector.